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Stages of Change, Dropouts, and Outcome in Substance Abuse Treatment

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STAGES OF CHANGE, DROPOUTS, AND OUTCOME IN SUBSTANCE ABUSE TREATMENT

BY

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ABSTRACT

Despite the extensive evidence of the beneficial aspects of substance abuse treatment, questions on what contributes to successful outcome continue to arise. It is important to research who will be more likely to benefit from which modalities of treatment programs and for what length of treatment. Systematic investigations that include individuals' attitudes, intention and behavior towards their drug use are necessary to better understand the interaction between individual characteristics and treatment factors, as well as their effects on treatment retention and outcome. The Transtheoretical Model of Change offers a promising systematic framework for this purpose (Prochaska & DiClemente, 1983, 1984, 1992).

This study examined the predictive values of two constructs of the Transtheoretical model: stages of change and decisional balance on dropouts and outcome in substance abuse treatment (N=710). Both dynamic and static predictors of treatment dropouts and outcome were investigated. The current investigation is divided into four studies. The Change Assessment for Drug Use (CAD) was developed with sound psychometric properties in Study I. Study II searched for the best stage allocation method in using the CAD and its validation. Findings indicated that cluster analysis was the best stage allocation method. Study III investigated predictors for treatment dropouts and continuers. Dropouts were defined as individuals who dropped out of treatment within the first 60 days of the program. Significant predictors for dropouts included being in precontemplation, lower education, more previous treatment experience and perceiving treatment for social problems as more importance. In Study IV, both predictors at admission and discharge were examined for short-term (3-month post discharge) treatment outcome. Successful outcome was defined as abstinence of drug use since exit of treatment. Being in the preparation stage of change at baseline, having lower depression level at discharge and longer length of stay in treatment were significant predictors for successful outcome. Results indicated that dynamic predictors such as stages of change, length of stay and

depression level outweighed all static variables, such as subject characteristics, for prediction of short-term outcome. Implications of current and future directions of research were discussed.

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"Praise the Lord, O my soul, and forget not all his benefits." -- Psalm 103:2

PREFACE

Stages of Change, Dropouts, and Outcome in Substance Abuse Treatment: Overview

Before the first generation of drug abuse treatment appeared, which was in a form of therapeutic communities, "Once an addict, always an addict" was widely presumed (Hubbard, Marsden, Rachal, Harwood, Cavanaugh, & Ginzburg, 1989). The first generation of programs provided treatment primarily to heroin addicts. Addiction was viewed as a reflection of fundamental defects in character and maturation. Therapeutic community (TC) approach therefore geared toward lifestyles and required long-term stays in residential facilities with highly structured environment. Not until positive results were reported from the first therapeutic community, Synanon, which claimed that former heroin users were free of drugs for more than a year, did the new generation of treatment modalities begin to proliferate. In 1965, Dole and Nyswander introduced methadone maintenance as an alternative to heroin addiction treatment. This treatment approach was based on a very different understanding of addiction as a metabolic disease. Although treatment outcome was generally favorable with sustainable heroin reduction, decreased criminality and general health improvements (Dole & Nyswander, 1965; Dole, Nyswander & Warner, 1968), doubts still remain as the possibility of discontinuing methadone has not been clear (Hubbard et al., 1989). With growing needs for treatment for a variety of illicit drug use, a third treatment modality, outpatient drug-free treatment that served both opioid and non-opioid addicts began to flourish. Treatment approaches that might reduce the cost of drug abuse in society started to expand.

In late 1970s', with the blooming of cognitive-behavioral approaches drawn from social learning theory, behavior therapy and cognitive and social psychology (Bandura, 1977, 1982; Rosenstock, Strecher, & Becker, 1988), the etiology of addiction was formulated as a learned behavior addicts use to cope with stressful situations. Intervention was geared toward

substituting positive behaviors for drug use behaviors through teaching coping skills to appropriately handle high risk situations for drug use. Sustaining abstinence was viewed as a result of increased self efficacy for avoiding drug use in high risk situations.

Increases in understanding of drug addiction and its recovery has helped interventionists recognize the importance of dealing with lapses and relapses. A new approach for addiction treatment, relapse prevention, was introduced (Marlatt & Gordon, 1985). This approach focused on preventing a lapse from becoming a full relapse through reframing lapses as opportunities to learn about triggers and high risk situations. Individuals are taught to identify triggers for drug use and coping strategies to avoid or to cope with those triggers. The major modalities of current drug abuse treatment take the form of methadone maintenance, drug-free residential treatments (including therapeutic communities, and cognitive-behaviorally oriented residential programs), and outpatient drug-free programs (Hubbard et al., 1989).

The fast growing substance abuse treatment approaches over a short history of 30 years reflects the increasing burdens of substance abuse on society. In 1988, it was estimated that the costs of alcohol abuse and the abuse of other drugs in the US. were $86 billion and $58 billion respectively (Stimmel, 1991). As of 1990, the estimated costs increased to $99 billion and $67 billion for alcohol and other drug abuse respectively (Institute for Health Policy, 1993). The core costs of substance abuse fall in medical expenses, illness, premature deaths, and criminality. Given the role of IV drug users in the spreading of AIDS and the high association of drug use and crime, drug addiction is not only a health concern at an individual level but also a broad social problem. The threat imposed by drug users on both public health and safety has encouraged civil commitment practices directed toward drug users. Drug abuse treatment programs nowadays serve multiple purposes of protecting societies and promoting individual well-being (Brown, 1988; Platt, Buhringer, Kaplan, Brown, & Taube, 1988). There has been

extensive evidence showing that most drug addiction treatments, regardless of modalities, benefit their clients (e.g., Institute of Medicine, 1990). However, questions as to what contributes to successful treatment, and to successful outcome continue to arise.

Research on predictors for treatment outcome has yielded divergent results. Some studies have found that positive outcomes appear to relate to subjects who are older, male, white, being employed full time, being first time in treatment, and having lower ratings on severity of drug use. However, some experts suggest there is little relationship between most sociodemographic variables and outcome (e.g., Gorelick, 1992; Hubbard et al., 1989; Kosten, Rounsaville, & Kleber, 1987). Regarding sources of referrals (legal versus self), the literature has not shown consistent support for an association between legal referral and outcome success (Hubbard, Colline, Rachal, & Cavanaugh, 1988). Research has begun to examine relationships between HIV status and treatment outcome, but no substantial relationship with outcome has been reported. However, HIV positive individuals appear to be more motivated (McCusker, Bigelow, Frost, Hindin, Vickers-Lahti, & Zorn, 1994) and tend to more likely complete treatment (Weddington, Haertzen, Hess & Brown, 1991). In one study, increased self-efficacy during treatment has been found to be higher among abstainers than relapsers at follow-up (Burling, Reilly, Moltzen, & Ziff, 1989). However, no relationship was found between self-efficacy ratings and outcome status in another study (Mayer & Koeningsmark, 1991). Other subject characteristics such as psychiatric status, cognitive functioning, and their relationships with outcome have also been studied. Relatively poor treatment outcomes appear to be related to impaired cognitive functioning, major depressive disorder, and antisocial personality disorder (e.g., Fals-Stewart & Schafer, 1992; Kay, 1985).

One of the major problems of finding reliable predictors for treatment outcome across studies is the high dropout rates in these treatment programs. Indeed, the length of stay in

treatment has been shown to be the single most consistent predictor of outcome (Charuvastra, Dalali, Cassuci, & Ling, 1992; DeLeon, 1988; DeLeon & Jainchill, 1986; French, Zarkin, Hubbard, & Rachal, 1993; Hubbard et al., 1989) across all treatment modalities. For example, from the data of the Drug Abuse Reporting Program (DARP), the first large scale national study on treatment effectiveness for drug abusers, a minimum of three months was found to be necessary to produce positive changes, and outcomes improved with the onset of time staying in treatment after the first three months. Similarly, the second national study, the Treatment Outcome Perspective Study (TOPS) that tried to assess effective elements in treatment, has also found that treatment tenure relates positively to treatment success (Hubbard et al., 1988). The TOPS data suggested that treatment lengths of six months or more were necessary to produce reductions in drug use. Research comparing treatment outcome of dropouts versus completors has been able to consistently yield more favorable outcome for treatment completors (e.g., Baekeland & Lundwell, 1975, Hubbard et. al., 1989, Stark, 1992). The positive relationship between treatment retention and successful outcome is also a reason why treatment retention has been commonly used as a measure or an indicator of treatment outcome.

Unfortunately, like treatment of other psychological problems, dropout is prevalent in all drug abuse treatment programs (DeLeon & Jainchill, 1986). The majority of clients drop out of treatment prematurely, i.e., most clients drop out well before treatment takes full effect. Review of research findings has shown that the highest dropout rates are found in outpatient drug-free programs, with at least 50% dropping out during the first month and over 80% within three months (Agosti, Nunes, Stewart & Quitkin, 1991; Baekeland & Lundwall; 1975, Stark, 1992). The base rates of 12-month retention among therapeutic communities surveyed ranged from 4% to 21% (DeLeon & Schartz, 1984). In other residential settings, completion rates for 4-6 month programs have been reported as less than 30% (Sidall & Conway, 1988; Stahler, Cohen, Shipley

& Bartelt, 1993). Dropout rates in outpatient methadone programs appear the lowest but still endorse a high rates range from 7% to 64% within the first 6 months (Baekeland & Lundwall, 1975). Among outpatient detoxification programs, dropout rates ranged from 26% to 69% (Baekeland & Lundwall, 1975). Investigators have been trying to search for characteristics of dropouts such as demographics, addiction severity, drug related behavior, and legal status, but no powerful and reliable predictors have been identified (Condelli & DeLeon, 1993; Craig, 1984; DeLeon, 1985; DeLeon & Jainchill, 1986; Hubbard et al., 1989).

Despite the finding that treatment retention is one of the few consistent predictors of outcome, the true relationship between retention and outcome is not well understood. Research continues to show contradictory findings. For example, no association was reported between number of treatment sessions and improved outcomes in outpatient treatment for cocaine addicts (Kang, Kleinman, Woody & Millman, 1991). Carroll, Power, Byrant, & Rounsaville (1993) have found that variables associated with longer retention in treatment tend to predict poorer outcome at a one-year follow-up of cocaine addicts. In TOPS, the second largest nationwide study on substance abuse treatment effectiveness, Hubbard et al. (1989) reported significant relationships between treatment retention and outcome for use of posttreatment marijuana but not for the use of heroin and cocaine. The findings from research on treatment effectiveness have revealed that an "appropriate" or to some extent "minimum" exposure to treatment is necessary to produce positive outcome, rather than there being a causal relationship between longer retention and better outcomes as loosely implied by most literature on retention and treatment. In other words, some individuals may benefit from longer treatment, but some may have equally successful outcomes with a shorter length of stay. Furthermore, longer retention also means more drug addicts will have to wait on line for treatment given that treatment resources are limited. It is important to research who will be more likely to benefit from which

modalities of treatment programs and for how long of treatment. Some systematic investigations are therefore necessary to better understand the interaction between individual characteristics and treatment factors and their effects on retention and outcome in order to maximize treatment effectiveness.

Research investigating predictors for treatment retention and outcome has exhausted its use of different types of traditional fixed variables, such as demographics and drug use history without yielding consistent and productive findings. The field has therefore begun to explore the relative importance of dynamic predictors in comparison to the traditional fixed variables (Anglin, 1988; Condelli & DeLeon, 1993; DeLeon & Jainchill, 1986). Dynamic predictors are changeable characteristics of clients, such as their perception and experiences of current and previous treatment, and motivations (most commonly indicated by reasons for entering treatment). Findings have generally favored the use of dynamic variables to account for more of the variances in treatment retention and / or outcome. Some examples of the dynamic parameters that have been researched include psychological disturbance and symptoms (DeLeon, 1989; Carroll et al, 1993), clients' own estimate of how long they need to stay in treatment (DeLeon, 1991), and circumstances, motivation, readiness and suitability (DeLeon & Jainchill, 1986). Unfortunately, most of the dynamic variables researched are not easily standardized to enable replication across studies as well as cross validation using different treatment settings.

In order to advance the research in this area and to obtain better understanding of the contributors of treatment effectiveness, the use a systematic framework capturing individuals' attitudes, intentions and behavior related to their drug use will be necessary. The Transtheoretical Model of Change (Prochaska & DiClemente, 1983, 1984, 1992) offers a promising systematic framework for this purpose. The Transtheoretical Model has provided a useful conceptual framework in understanding how people change behaviors. It has been

successfully applied to a broad range of problem behaviors such as smoking (Prochaska & DiClemente, 1983), alcohol (DiClemente & Hughes, 1990), weight control (O'Connell & Velicer, 1988), drug abuse (Rosenbloom, 1991; Martin, Rossi, Rohsenow, Monti, & Rosenbloom, 1994; Tsoh, 1993), psychotherapy (Prochaska, Rossi, & Wilcox, 1991), and to some preventive behaviors including mammography, sunscreen use, and exercise (e.g., Rakowski. Dube, Marcus, Prochaska, Velicer, & Abrams, 1992; Rossi, 1989; Marcus, Rossi, Selby, Niaura & Abrams, 1992).

The Transtheoretical Model has found that as people change, they go through a series of stages that include Precontemplation (not intending to change in the foreseeable future), Contemplation (considering changing in the foreseeable future), Preparation (intending to change in the near future with a specific plan or some steps towards action taken), Action (actively engaged in changing a behavior) and Maintenance (sustaining the change and preventing relapse) (Prochaska & DiClemente, 1992). These stages of change capture specific constellations of attitudes, intentions and behavior of individuals going through the process of change. The progress from one stage to another may not necessarily be linear, but may be cyclical in many cases. Many people relapse several times and recycle back to earlier stages before they succeed in changing their problem behavior. Even for individuals who enter the same kind of treatment programs dealing with the same kind of problem behavior, their readiness to change may vary widely. As reasons or motivations to enter treatment are different among individuals, people enrolled in treatment may be in different stages of change ranging from Precontemplation to Maintenance. In the case of drug abuse treatment, precontemplators may be those clients who are not ready to change but they are forced to enter treatment against their own desires by factors such as the legal systems (Tsoh, 1993). On the other hand, some clients may be in action and

maintenance who have quit using drugs but need some support for sustaining the change (Rosenbloom, 1991; Tsoh, 1993).

Using the Transtheoretical Model of Change, 92% of the clients' continuation and termination status in psychotherapy was correctly predicted(Medeiros & Prochaska, 1991). Predictors were stages of change, processes of change, and decisional balance which are some of the core dimensions of behavior change as identified by the model (Prochaska & DiClemente, 1983, 1984, 1992). Most therapy continuers are found to be in the contemplation stage of change (Medeiros & Prochaska, 1991). On the other hand, premature terminators or dropouts are more likely to be in the precontemplation stage and tend to be more oriented toward changing their environment than themselves. It is also one of the key features of most precontemplators that they try to use defenses such as changing their environment in order to deny that they have a problem. Early but appropriate terminators were found to highly endorse the Action stage and were ready to take action when entering treatment. Therefore, they required fewer therapy sessions to achieve their therapeutic goals. Assessing stages of change and change processes at midtreatment predicted both attendance and outcome in worksite weight control programs, with both accounting for over 30% of the attendance variance and over 40% of the variance for the amount of weight loss during treatment. Higher endorsement of the action stage of change and the use of action-oriented strategies was found to enhance attendance and outcome(Prochaska, Norcross, Fowler, Follick & Abrams, 1992).

This study was a secondary data analysis on 710 drug addicts seeking treatment from 2 residential settings. The purpose of the current study was to examine the applicability of the Transtheoretical model for predicting treatment dropouts and outcome in the area of drug addiction. Dynamic predictors of treatment dropouts and outcome namely stages of change and decisional balance, were compared to other traditional fixed variables such as demographics and

history variables. Based on previous findings, the following hypotheses were tested in relation to the role of the stages of change in predicting retention and outcome.

1. Clients who were further along in the stages of change at admission would be less likely to drop out from treatment.

2. Clients who were further along in the stages of change at admission would be more likely to have better treatment outcome.

3. Clients who were further along in the stages of change at discharge would be more likely to have better treatment outcomes.

4. The predictive value of stages of change on treatment outcome would increase from admission to discharge

The current investigation is divided into four discrete but related studies and are presented in separate manuscript formats. Study I focused on instrument refinement of the Stages of Change Assessment Scale (URICA) and the Decisional Balance Scale. Study II evaluated various stage allocation methods using the URICA and their validation; stage membership of subjects at each time point was established for further analyses. Study III investigated predictors for treatment retention. Study IV examined predictors for treatment outcome. Lastly, a general discussion is presented based on findings from all four studies.

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Introduction

Drug addiction is frequently described as a chronic, relapsing disorder characterized by strong desire, or craving for drugs, and difficulty in extinguishing the behavior completely (Institute of Medicine, 1990). Similar to other addictive behaviors, "relapse is the rule rather than the exception with addictions" as Prochaska, DiClemente, and Norcross (1992) pointed out. Despite the development of treatment techniques and the blooming of a treatment industry for substance abuse, the need for more effective treatments continues to rise. The growth of substance use as well as the extensive phenomenon of high relapse rates among substance abusers have created a growing yet unmet need for more effective substance abuse treatment. Although research has generally suggested that treatment yields positive outcomes, however, between 10% to 20% of drug addicts complete treatment and about 70% of drug addicts relapse within the first year post treatment (Mejta, Naylor & Maslar, 1994).

As with many other addictive behaviors, substance abuse presents a challenge to researchers to understand the process of change that underlies successful recoveries. The Transtheoretical Model of Change developed by Prochaska and DiClemente (1983, 1984, 1992), which underscores the recycling process of behavioral change, provides a promising integrative framework to systematically study how people change addictive behaviors. The Transtheoretical Model has provided a useful conceptual framework in understanding how people change behaviors. It has been successfully applied to a broad range of problem behaviors such as smoking (Prochaska & DiClemente, 1983), alcohol (DiClemente & Hughes, 1990), weight control (O'Connell & Velicer, 1988), drug abuse (Rosenbloom, 1991; Martin, Rossi, Rohsenow,

Monti & Rosenbloom, 1994; Tsoh, 1993), psychotherapy (Prochaska, Rossi, & Wilcox, 1991), and to such preventive behaviors as mammography, sunscreen use, and exercise (e.g. Rakowski, Dube, Marcus, Prochaska, Velicer, & Abrams, 1992; Rossi, 1989; Marcus, Rossi, Selby, Niaura & Abrams, 1992).

The Transtheoretical Model has found that as people change, they go through a series of stages that include Precontemplation (not intending to change in the foreseeable future), Contemplation (considering changing in the foreseeable future), Preparation (intending to change in the near future with a specific plan or some steps towards action taken), Action (actively engaged in changing a behavior) and Maintenance (sustaining the change and preventing relapse) (Prochaska & DiClemente, 1992; Prochaska, DiClemente, & Norcross, 1992). These stages of change capture specific constellations of attitudes, intentions and behavior of individuals going through the process of change. The progress from one stage to another may not necessarily be linear, but may be cyclical in many cases. Many people relapse several times and recycle back to earlier stages before they succeed in changing their problem behavior.

Other dimensions of the Transtheoretical Model of Change include the processes of change, decisional balance, as well as self-efficacy. Processes of change represent the different strategies or techniques that people use at each stage of change and enable them to move from one stage to the next. Ten processes are currently included in the model underlying basic principles of change, which fall into two major constructs: experiential and behavioral processes (Prochaska & DiClemente, 1992). Experiential processes, such as consciousness raising, dramatic relief, environmental reevaluation, self-reevaluation and social liberation, have been found essential for producing movements across the early stages. Behavioral processes, including counterconditioning, stimulus control, reinforcement management, self-liberation, and helping relationships are strong predictors of successful action and maintenance of change. The

construct of decisional balance (pros and cons of a behavior) is another stage dependent construct of the model. This dimension, developed from Janis and Mann's (1977) model of voluntary decisional making model, denotes the relative rating of the pros and cons of changing a behavior. The consideration of pros and cons for a behavior is particularly relevant to the early stages of change such as precontemplation, contemplation and preparation. Self-efficacy, another construct of the model adapted from Social learning theory (Bandura, 1977, 1982) underlies the precepts of personal efficacy influencing motivations and behavior. It is examined under confidence of carrying out the new acquired behavior or avoiding the problem behavior, as well as temptation. This construct has been found successful in predicting movement in later stages, such as action to maintenance.

The key to apply the model is by first accurately accessing the stages of change. There is no single way to achieve this purpose (Prochaska & DiClemente, 1992). Generally, the ways of accessing stages of change can be achieved through a categorical algorithm or a continuous measure. The categorical stage assessment involves a stage algorithm which consists of dichotomous questions to assess persons' readiness for change, or a series of statements describing each different operational definition of stages. Each stage is operationalized by intention and behavior within a certain time frame. (Prochaska & DiClemente, 1992). When applied to a substance use problem such as smoking, Precontemplation is operationalized as no intention to quit smoking in the next 6 months. Contemplation involves intending to quit smoking in the next 6 months. Preparation involves intending to quit in the next 30 days plus a 24-hour quit attempt within the last year. Action is defined as having quit for less than 6 months. Lastly, Maintenance is operationalized as having quit for more than 6 months.

Previous studies have applied similar forms of stage algorithm to assess stages of change in cocaine use and other drug use (e.g., Rosenbloom, 1991; Tsoh, 1993). However, several

problems have been noted in applying the current algorithm to drug addicts in treatment. Under the algorithm, drug addicts who are seeking drug-free treatment are automatically classified into "action" because of being in a controlled, drug-free environment. Therefore, over-classification of individuals into "action" may occur simply by assuming that individuals are ready and prepared to change when they are in treatment. For example, over 85% of the subjects in Rosenbloom's study (1991) were classified into either action or maintenance. In addition, using the stage algorithm method in this population seems to posit an accuracy problem in assessing readiness for change. In a previous study on 230 drug addicts recruited from various residential and outpatient settings (Tsoh, 1993), 50% of subjects who claimed to be in action or maintenance also reported simultaneous use of illicit drugs. When compared to the assessment of stages using a continuous measure, such as the University of Rhode Island Change Assessment Scale (URICA, McConnaughy, Prochaska, & Velicer, 1983), the stage algorithm was shown to be less capable of producing distinguished stages of change (Tsoh, 1993).

The URICA (McConnaughy et al., 1983, McConnaughy, DiClemente, Prochaska, & Velicer, 1989) was originally designed as a clinical tool to assess readiness for change among clients seeking psychotherapy. The measure consists of four scales representing the precontemplation, contemplation, action and maintenance stages of change. Assessment of stages is achieved through grouping individuals based on their profiles on these four scales through cluster analysis techniques. Assessing stages of change based on a continuous measure that consists of a number of items has an advantage of increased reliability. The validity of the self-report responses increases since the URICA is a much more subtle assessment. Furthermore, a continuous measure enables the development of typologies of change by considering an individual's degree of endorsement in each of the stages of change, which a discrete stage algorithm can not provide. The change assessment measure has been shown to be

a valid measure to capture stages of change in psychotherapy, as well as in a number of health behavior problems including drug addiction, alcohol use, weight control, smoking acquisition, and exercise (e.g., DiClemente & Hughes, 1990; Martin et al., 1994; Prochaska et al., 1992; Reed, 1995; Rossi et al., 1994; Tsoh, 1993). The purpose of this study was to refine the stages of change instrument for use in drug addicts at admission and during treatment, as well as at post treatment.

Methodology

Participants

Participants were 710 former addicts (30% females) recruited for the study from two residential facilities: 493 from a cognitive-behavioral relapse prevention program and 217 from a therapeutic community. Mean age was 29.8 years (SD = 6.1). The ethnicity composition of the sample was 74.8% Caucasian, 18.2% Black, 5.9% Hispanic, and 1.2% other. The mean education level was 12th grade. There were 35.5% who had a full time job at the time of treatment and 37.8% were unemployed, while others worked part time, or had retired. The majority (86%) of the subjects had previous admissions to drug abuse treatment programs prior to the study. Main drugs of choice for the sample were heroin only (22.1%), cocaine only(26.4%), alcohol and drugs (24.5%), and polydrug (21.8%), with 43% IV drug users.

Procedures

Participants were recruited during intake interviews that took place within 14 days before or on the day of admission. Clients who were eligible to participate in the present study were all former drug abusers who completed detoxification or withdrawal, and were admitted to the facilities on a voluntary basis. Monetary incentives for participation (see below) were offered. Data were collected during admission, exit, and a 3-month follow-up post discharge.

Participants received $15 for each research interview at admission and at exit of treatment, and $25 for each post-treatment interview.

At the relapse prevention facility, clients were randomized to receive either a 3- or a 6-month program regardless of their participation in the study. The treatment programs were based on a relapse prevention / health education model focusing on teaching coping skills for managing clients' addictive attitudes and behaviors in order to cope with high risk situations for relapse. Subjects recruited from the therapeutic community were randomly assigned to receive a 6-month or a 12-month therapeutic community program. Both programs aimed at introducing clients to a highly structured life-style provided in a communal living setting. In both facilities, the components of the short and the long programs (3- vs. 6-month in Spectrum and 6- vs. 12-month in Marathon) were the same but they differed in duration with each component in the long program lasting twice as long as in the short programs. Eight-two subjects were recruited before the randomization of treatment duration began, and these subjects were included in measurement analysis and instrument validation of the Stages of Change Assessment Scale.

Admission interview took place in 2 to 3 sessions that occurred during the first 8 days after admission. Data at exit were obtained from 7 days before anticipated day of discharge to 3 weeks after discharge, 70% of the total subjects were interviewed within this window. The 3-month interview occurred between 2 to 6 months post-treatment with a follow-up rate of 86%.

Measures

Variables of interest for the current study are obtained from the following measures. Not all the measures were administered at all time points. Appendix A shows a summary of the measures and the time points where each was administered.

Change Assessment of Drug Use (CAD)

Modified from the University of Rhode Change Assessment Questionnaire (URICA), CAD is a 32-item questionnaire developed to assess subjects' readiness to change their problem behavior (McConnaughy, Prochaska, Velicer, 1983; McConnaughy, DiClemente, Prochaska & Velicer, 1989). For the purpose of the present study, instructions were modified to ask subjects to refer to their drug use as the problem behavior during the interviews. Some minor changes were made in the wordings relating to the place of treatment in order to make the instrument more applicable for follow-up interviews when subjects were no longer in treatment. For example, "I'm hoping this place will help me to better understand myself" (original) was changed to "I'm working on my problem to better understand myself". Subjects were asked to respond on a 5-point Likert Scale ranging from 1= strongly disagree to 5=strongly agree. Eight items comprised each of the four stages of change: Precontemplation (PC), Contemplation (C), Action (A) and Maintenance (M). The Change Assessment Questionnaire has been shown to be a valid measure to capture the stages of change in psychotherapy as well as in various health behavior problems including alcohol use, drug addiction, and weight control (e.g., DiClemente & Hughes, 1990; Martin, Rossi, Rohsenow, Monti & Rosenbloom, 1994; Prochaska, Velicer et al., 1992; Tsoh, 1993). Bellis (1993) has refined the 32-item URICA into a 18-item URICA from various samples of psychotherapy outpatients (n=310) including the original samples from McConnaughy et al's studies (McConnaughy et al., 1983; 1989). The refined version demonstrated good psychometric properties. In applying the URICA to cocaine use, Martin and colleagues (1992, 1994) derived a 16-item version of Cocaine Change Assessment Questionnaire. The psychometric properties of the measure were further examined and refined in the present study. Items of the measure are shown in Appendix B.

Decisional Balance Inventory

The 12-item scale modified from the Cocaine Decisional Balance Inventory (Rossi, Rosenbloom, et al. 1993) was used. With some wording changes replacing "cocaine use" with "drug use", this 12-item version has been shown to be a valid measure for the decisional balance construct in a sample of drug addicts in treatment (Tsoh, 1993). Subjects were asked to rate each item on a 5-point Likert scale ranging from 1= not important to 5= extremely important. The items represent PROS and CONS for drug use with 6 items on each dimension. The psychometric properties of this measure was further examined in this study. Items of the measure are shown in Appendix C.

Self-efficacy to avoid drugs

This self-efficacy scale contains 5 items assessing subjects' confidence in their ability to avoid drug use in high risk situations during the next 3 months. Subjects were asked to respond on a four point Likert Scale: 1=extremely confident to 4=not at all confident. Total score is the sum of all 5 items reverse scored, with the higher total score indicating higher confidence. The scale was developed based on data collected in this study at admission through various versions of the instrument with an item pool of 11 or 24 items. The factor structure was refined using the shorter version (n=370) and was confirmed using the long version (n=217). The internal consistency of the measure, Cronbach's alpha was .82 (Rubin, 1993). Items are shown in Appendix D.

Social Desirability Scale

Jackson's Social Desirability Scale (Jackson, 1967) was used to assess response bias due to social desirability. This instrument consists of 20 items that are presented in a true-false format. It has been found to be a valid and reliable measure to determine if a response set tends toward the direction of social desirability. The measure was administered at admission only.

Other variables

Data on other variables that have some association with outcomes or retention from previous studies were also collected. Those variables include HIV status, sources of referrals, length of stay in treatment, and status of completion.

Analyses

The purpose of this study was to refine and to examine the psychometric properties of the Stages of Change Assessment for Drug Use Scale (CAD) as well as the Decisional Balance Inventory for drug use. Even though the factor structure of both scales validated and replicated across studies (McConnaughy et al., 1983, 1989; Rosenbloom, 1991; Tsoh, 1993), examination and revision of the instruments were necessary, because some wordings were changed on both scales for the current study and the instruments were used at various time points both at admission, discharge and post-treatment. Half of the sample was used as an exploratory sample for item reduction, and the remaining half was used as a confirmatory sample. Both scales were obtained at all time points. Data used for instrument development were based on the data collected at a time point that offered the best statistical distribution (means, skewness, and kurtosis) for each item.

Item reduction

Half of the sample were used for the following analyses. Item selection was based on item analysis, principal component analyses (PCA), confirmatory factor analyses (CFA) techniques, and internal consistency. Velicer's (1976) minimum average partial (MAP) procedure and parallel analysis using Lautenschlager's (1989) guidelines based on Monte Carlo analyses were used to help determine the number of components to be retained. Both MAP and the parallel analysis have been shown to be the most accurate procedure for determining the number of components to retain across a wide range of simulated situations (Zwick &

Velicer, 1986). The number of components to be retained were based on both statistical and theoretical considerations. Item deletion was based on one of the three criteria including factor loadings (from both PCA and CFA), coefficient alphas and item analysis. Items with loadings less than .50, loadings on a non-target component (theoretically wrong component), or items that are complex (load on more than 2 components with loadings greater than .40) were eliminated. Coefficient alphas were computed to indicate the internal consistency of each component. Items with low or negative total-item correlations, which lowered the internal consistency of a subscale, were deleted. In addition, items that had a highly skewed distribution, high (4.0 or greater) or low (2.0 or less) mean endorsement, and / or significantly high correlation (.30 or greater) with the Jackson Social Desirability Scale (Jackson, 1967) were candidates for deletion.

Confirmation of factor structure

The factor structure of each refined instrument was evaluated by confirmatory factor analysis using structural equation modeling techniques on the remaining half of the sample. Studies on measurement analyses based on the Transtheoretical Model have been able to use such techniques successfully (e.g. Bellis, 1993; Blais, 1991; Marcus, Rossi, Selby, Niuara, & Abrams 1992). Maximum Likelihood (ML) was employed as an estimation procedure based on its robustness against small sample sizes (Boomsma, 1987). The plausibility of the proposed model was evaluated by the measures of goodness of fit including the chi-square statistic (χ^2), the root mean square residual (RMSR), and comparative fit index (CFI) (Bentler, 1990). Furthermore, significance of individual parameters (e.g. loadings of items) were assessed.

The chi-square statistic is an absolute measure of fit. A non-statistically significant and small chi-square relative to its degree of freedom is generally considered as a good fit. However, as chi-square statistic is not robust to violations of its assumptions such as non-

normality and is therefore not to be used as the only goodness of fit measure (Long, 1983). The RMSR is a measure of the amount of variance unexplained by the model. Generally, a RMSR of 0.06 or less indicates an acceptable fit (Hayduk, 1987). The CFI is an index that measures the relative fit of the model as compared to the null model in which no factor structure is assumed to exist among the items. This index ranges from 0 to 1 with the latter being a perfect fit. A CFI of .90 or above is generally considered an excellent fit of the model to the data.

In addition, the proposed structure was compared to alternative models, and the differences among the fit indices were compared and further used to evaluate the factor structure of the scale. Model comparisons included a series of alternative models ranging from a null model (for CFI calculations), a one-factor model (where a single latent factor is hypothesized to explain all items) to a one hierarchical factor model (where a second-order latent construct is hypothesized to underlie the first-order factors).

Results

Change Assessment for Drug Use (CAD)

Item analyses of the 32 items were conducted on baseline, exit and follow-up data in order to select the most appropriate item pool for the item reduction process based on item characteristics (mean, skewness and kurtosis). A mean of less than 1.0 or more than 4.0 (on a scale range of 1-5), skewness or kurtosis greater than |2| were considered inappropriate item characteristics with potential for item deletion. Item analyses of both baseline and exit data showed that a majority (27 out of the total 32 items, 84% at baseline, and 25/32, 78% at exit) of the items were excessively skewed or kurtotic, which suggested that data at baseline or at exit were not appropriate for instrument refinement using PCA or CFA procedures. The follow-up data, however, showed that 23 out of the 32 items (72%) had a reasonable statistical distribution

and therefore, the instrument refinement procedures proceeded using data collected at follow-up. Subjects with complete data were randomly split into an exploratory sample (n=304) and a confirmatory sample (n=298). Statistical comparisons across these two samples suggested they were similar in all characteristics as well as item statistical distribution. Therefore they were appropriate for cross validation purposes.

Exploratory analysis

A principal components analysis (PCA) was conducted on the URICA using the exploratory sample (n=304). A 32 X 32 matrix of interitem correlations was used as input for each analysis based on 304 subjects. The number of components to retain was determined by Velicer's (1976) minimum average partial (MAP) procedure and parallel analysis using Lautenschlager's (1989) guidelines based on Monte Carlo analyses for determining parallel analysis criteria. Both MAP and the parallel analysis have been shown to be the most accurate procedures to determine the number of components to retain across a wide range of simulated situations (Zwick & Velicer, 1986).

A three-factor solution was suggested by MAP, while a 4-factor solution was supported by the parallel analysis. Both solutions were considered. The 3-factor solution yielded a Precontemplation component, an Action component and a component that consisted of items from the Contemplation and Maintenance scales as originally proposed. Both varimax and oblique rotations yielded consistent results. The 4-factor solution resulted in a clear 4-factor structure which was consistent with the originally proposed factor-structure using both varimax or oblique rotations. Given that the 4-factor structure was more meaningful and of theoretical relevance, the 4-component solution was used to proceed with item reduction.

Item deletion was based on one of the three criteria including factor loadings, coefficient alphas and item analysis. A confirmatory factor analysis (CFA) based on the correlated 4-factor

model originally proposed by the questionnaire was performed on the 32 items using Maximum Likelihood (ML) estimation procedure. Items that had low loadings (< .50) in both PCA and CFA, and loaded on a non-target component (theoretically proposed component), or items that were complex (loaded on more than 2 components with loadings greater than .40) were deleted. Coefficient alpha was also computed to indicate the internal consistency of each component. Items with low or negative total-item correlations, which lowered the internal consistency of a subscale were deleted. In addition, items were not retained if they had a highly skewed distribution, high (4.0 or greater) or low (2.0 or less) mean endorsement. Further PCA's using oblique rotations and CFA's were conducted. A final 16-item version of the Change Assessment for Drug Use (CAD) was derived.

Results of PCA: The four factors, Precontemplation, Contemplation, Action, and Maintenance represented perception of one's readiness for quitting drug use. All four components accounted for 59% of the item variance. Items loadings were high, ranged from .59 to .85. Table 1-1 presents the final 16 items and their loadings on each component.

Results of CFA: Assessment of the goodness of fit measures indicated the four-factor correlated structure of the final 16-item was an acceptable factor structure, with the chi-square statistic χ^2 (98) = 184.50, RMSR = .057, GFI = .93 and CFI = .93. All factor loadings were statistically significant ($p < .001$), ranging from .45 to .82 with a mean of .65. The factor loadings and error variances are shown in Table 1-2.

The coefficient alphas for the Precontemplation, Contemplation, Action, and Maintenance subscales were .71, .76, .85, and .63 respectively.

Confirmatory Analysis

In order to test adequately the four-factor model derived from the exploratory analyses above, a series of alternative models representing potential factor structures of the measure were

imposed on the independent confirmatory sample (n=298). A confirmatory factor analysis based on structural equation modeling was conducted using the LISREL VII statistical package (Joreskog & Sorbom, 1989) on a 16x16 correlation matrix generated from the confirmatory sample. Maximum Likelihood (ML) was employed as an estimation procedure based on its robustness against small samples ($n \geq 200$) (Boomsma, 1987). The plausibility of this four-factor correlated model was evaluated by the measures of goodness of fit available in LISREL VII including the chi-square statistic (χ^2), the root mean square residual (RMSR), the goodness of fit index (GFI), comparative fit index (CFI) (Bentler, 1989; 1990), and the parsimony fit index. The alternative models tested are described below.

Null Model This model assumed no relationship existed among the factors or items. It was used to be compared against a proposed model to yield the comparative fit index. It is not a proposed alternative model.

One Factor Model The one factor model postulated the underlying structure of the measure was unidimensional. Support for this model would suggests that individuals do not differentiate among various stages of readiness in their attempts to change their drug use.

Two Factors Uncorrelated Model This model proposed that individuals are differentiated between 2 discrete stages with respect to change of drug use: a Pre-action (Precontemplation + Contemplation) and an Action stage (Action + Maintenance). The two-factor model conceptualizes drug addicts into two distinct groups. They are either in denial of their drugs problems with no intention to quit or are considering changing and/or are in the process of quitting. The uncorrelated structure of the model indicates that the two stages proposed are independent of each other.

Two Factors Correlated Model This model was almost identical to the above model except that the two factors were proposed to be correlated. Therefore, individuals were viewed

as progressing continuously from one stage to the next depending on endorsement on each of the scales.

Three Correlated Factors Model Previous study in smoking acquisition among adolescents supported a three correlated factors model (Stern , Prochaska, Velicer & Elder, 1987). This model posited 3 stages of change: Precontemplation, Decision Making (Contemplation + Action), and Maintenance. It suggests that individuals could either 1) have no intention to quit using drugs; 2) be in the process of considering quitting and/or have initiated some changes; or 3) have already quit using drugs and are working actively on maintaining abstinence.

Four Uncorrelated Factors Model This model was identical to the four-factor structure supported by the exploratory analyses, except that the four factors were proposed to be Uncorrelated. The four factors model suggests that individuals can be differentiated across four independent stages of change: Precontemplation, Contemplation, Action, and Maintenance.

Four Correlated Factors Model This model was derived from the previous exploratory analyses. It is similar to the previous model, except that the four factors are proposed to be correlated. The model suggested that individuals differ across four correlated stages of change, which was consistent with previous findings for other health behaviors such as in psychotherapy (Bellis, 1993; McConnaughy et al., 1983; McConnaughy et al., 1989), alcoholism (DiClemente & Hughes, 1990), and sun exposure (Blais, 1991). Support for this model would warrant the examination of a hierarchical factor model.

Single Hierarchical Factor Model This model suggested that there was a second order latent factor accounting for the variances in the four first-order factors. A hierarchical factor "Stage" was imposed on the four-correlated-factor structure tested above. Support for this model

would indicate that the Change Assessment for Drug Use scale (CAD) could be used as a single continuous measure.

Table 1-3 presents the results of the model comparisons. Findings suggested that the four correlated factors model provide the best fit of the data observed, with the chi-square statistic χ^2 (98) = 211.74, RMSR = .060, GFI = .92 and CFI = .90. All factor loadings were statistically significant ($p < .001$), and ranged from .34 to .80 with a mean of .63. The factor loadings and error variances are shown in Table 1-4. Internal consistency coefficient alphas for Precontemplation, Contemplation, Action and Maintenance scales were .74, .68, .85 & .60 respectively. The absolute value of the correlations among the four factors ranged from .11 to .52 implying the existence of a hierarchical factor structure.

Evaluation of the single hierarchical factor model indicated an acceptable factor structure for the data with good assessment of the goodness of fit measures: chi-square statistic χ^2 (100) = 238.08, RMSR = .068, GFI = .91 and CFI = .89 (Table 1-3). The variances of all factors accounted for by the second order hierarchical factor were significant ($p < .001$), with R^2 for PC, C, A, :& M = .23,.99,.23, & .23 respectively. Results provided preliminary support for the hierarchical factor structure of the CAD and a CAD total score was created by the sum of the final 16 times with the Precontemplation items reverse-scored. Internal consistency of the 16-item CAD scale based on the confirmatory was .79.

Scale means, standard deviations, coefficient alphas and scale correlations based on the combined sample at each time point: admission, discharge, and follow-up are presented in Tables 1-5, 1-6, &1-7 respectively. Correlations between each of the scale and the Jackson Social Desirability Scale (Jackson, 1967) were also calculated (Table 1-5) at baseline. Two of the scales A & M were found to be significantly correlated with the Social Desirability Scale; however, the correlation was in an acceptable range (<.15).

Decisional Balance for Drug Use

A principal components analysis was performed on a 12 X 12 matrix of interitem correlations from the 12-item questionnaire using the whole sample at admission with complete data (N=636). A two-component solution was suggested by both MAP (Velicer, 1976) and parallel analysis using Lautenschlager's (1989) guidelines. The two components accounted for 51% of the total variance. The factor solution reflected a Pros and a Cons components as shown in previous studies (Rosenbloom, 1991; Tsoh, 1993). Each of the Pros and Cons components contained the six items that originated from the Pros and Cons scales, respectively, of the instrument. The 12 items and their loadings on each scale based on varimax rotation are shown in Table 1-9. Both scales showed an acceptable internal consistency with coefficient alphas of .71 and .86 for Pros and Cons scales respectively (Table 1-8). Internal consistency for each scales at other time points of discharge and follow-up were calculated and found to be acceptable across each time point (Table 1-8). The coefficient alpha of the Cons scale showed a gradual increase from .71 at admission to .83 at follow-up. Both scales were significantly correlated with the Social Desirability Scale (Jackson, 1967) at admission but the correlation was acceptable (<.32) (see Table 1-8). Findings suggested that no further instrument refinement was necessary. Pearson correlations among CAD, decisional balance, and self-efficacy measures at admission, discharge, and follow-up-up are presented in Table 1-10,Table 1-11, and Table 1-12 respectively.

Discussion

Results provided support for the application of the measures based on the Transtheoretical Model in the area of substance abuse treatment. A 16-item Stages of Change Assessment for Drug use (CAD) was developed from the original 32-item URICA scale. The scale demonstrated reasonable psychometric properties across admission, discharge and follow-

up in the present study. The measure of Decisional Balance Inventory for Drug Use was shown to be reasonably successful in adapting to the drug addict population in the current investigation given some modifications in wordings of the items which is consistent with findings from a previous study (Tsoh, 1993). Some scales from the measures based on the Transtheoretical Model of Change were found to have significant but relatively weak correlations with the Jackson Social Desirability Scale (1967), all of which were less than +/- .32, i.e. with less than 9% of the variance associated with social desirability.

The analyses of the CAD revealed a four-factor structure that was consistent with the originally proposed scales in previous studies (Bellis, 1993; DiClemente & Hughes, 1990; McConnaughy et al., 1983, 1989). The four-correlated factor structure was cross-validated using two independent samples. When compared to the 18-item refined version of URICA (Bellis, 1993) derived from various psychotherapy outpatient samples, 11 out of the final 16 items of CAD overlapped with the 18-item URICA scale. As compared to the Cocaine Change Assessment Questionnaire (Martin et al., 1992; 1994), a 16-item version of the URICA refined from a cocaine user sample which has 9 items overlapped with the 18-item URICA (Bellis, 1993), the current version based on a mixed drug users sample indicated an overlap of 10 items with Cocaine Change Assessment. The large amount of overlap in items indicated the generalizability of the stages of change assessment measure across different problems areas.

Scale statistics indicated a rather positively skewed distribution on the PC scale. Subjects tended to disagree with PC items, and to agree with C, A, and M items. Previous studies have indicated a slightly skewed distribution particularly with the PC scale. It is therefore recommended that the use of the scale is more meaningful and practical when scores are standardized as opposed to raw scores due to response bias (Prochaska & DiClemente, 1992).

Previous studies using URICA in psychotherapy have demonstrated a simplex structure of the measure (Bellis, 1993; McConnaughy et al., 1983, 1989). A simplex pattern is indicated by higher correlations between adjacent stage (factor) as compared to non-adjacent stage. This pattern has been found to support the theory proposed by the Transtheoretical Model of Change that individuals progress from one stage to the next, where PC, C, A & M indicated the anchor points of stages in a continuum. In a simplex pattern, PC is expected to be more highly correlated with C, C with A, and A with M. In the current study, a simplex pattern was observed among the PC, C and A scales at all time points. However, the M scale did not demonstrate a simplex pattern as proposed. Indeed, it was the mostly highly correlated with C (.32 to .34) instead of A as proposed; and it was weakly correlated with A (.03 to .22) across all time points. A previous study using the original 32-item URICA with refinement on a sample of drug addicts in treatment demonstrated a simplex pattern (Tsoh, 1993). However, the high inter-correlations among C, A, & M (ranging from .61 to .81) were indicative of significant "complex" items (highly loaded on more than one scale) that called for further refinement of the instrument for a drug-user population. Other studies on "acquisition" type behaviors such as exercise (Reed, 1995), sun exposure (Blais, 1992) and adolescent cigarette smoking (Stern et al., 1987) did not demonstrate a simplex pattern of the measure. Indeed, it has been recently demonstrated and validated that the URICA measure had a circumplex structure when applied to exercise behaviors (Reed, 1995).

Nevertheless, the lack of relationship between the Maintenance and Action scales suggested potential problems in which individuals who endorse highly on M might not necessary have worked through the problems, or were working actively on quitting drugs (endorsement on Action). By inspecting the content of the Maintenance scale items, it concentrated mostly on whether someone was aware of and/or were experiencing a relapse concurrently. There was not

much indication of individuals' experience in successfully progressing through maintaining the changes as shown by the Maintenance scale items. Therefore, it might be necessary to revise the M items by including items that describe successful progress and experience in maintaining the change.

Results of the confirmatory factor analysis using structural equation modeling provided support for a single hierarchical factor. Carbonari and colleagues (Carbonari, DiClemente, & Zweben, 1994) employed a single score of readiness based on the URICA refined for alcohol outpatients (DiClemente & Hughes, 1990) and demonstrated preliminary support for the use of the readiness score. Further validation on using CAD as a single continuous measure will require comparison of scores across stages and validation with other Transtheoretical Model measures such as pros, cons, self-efficacy. Based on the current findings, correlations among the scales indicated preliminary support of the CAD score based on summing all items with PC reverse-scored suggesting a reasonable relationship with the Decisional Balance measure. CAD consistently showed a significant positive correlation with the Cons scale with a reasonable magnitude (.32 to .46) across time points and a weak correlation with the Pros, which in turn has been found to have a generally weaker relationship with the URICA scales. Consistent with the implication of the Strong Principle (Prochaska, 1994) that Cons of a problem behavior differentiate stages of change better with a minimum of 1 SD change from PC to A based on cross-sectional data. Therefore, the stronger relationship between the Cons and the CAD score might provide some support for CAD being a reasonable index for readiness of change. On the other hand, the lack of relationship between CAD and self-efficacy is somewhat puzzling. At admission, there was no relationship found between CAD and self-efficacy, and indeed the correlation between self-efficacy and CAD scales were rather weak. Comparatively, there was a stronger positive relationship yet still small in magnitude (.15 at discharge and .21 at follow-up)

at other time points. The lack of correlation at admission may be due to the problems of assessing self-efficacy. Subjects were asked to rate their confidence to avoid drug use in the following 3 months after they had committed themselves to treatment that was supposed to last for at least 3 months, therefore it would seem irrelevant to ask these individuals their confidence to avoid drug use in a controlled environment. The increase in correlation at later time points (at discharge, and post-treatment) supported the speculation. Future studies focused on the external validity of CAD total score as its ability to differentiate individuals across stages will help understand the usefulness of this scale.

Analysis on the Decisional Balance for Drug Use has also demonstrated its internal validity and reliability. The 12-item measure adapted from Rossi et al.'s (1993) Cocaine Decisional Balance Inventory was shown to be appropriate for the drug addicted population in the current study. The results have supported that these two scales, Pros and Cons of decisional balance can be used to test the external validity of the stages of change. It has been consistently demonstrated in previous studies based on the Transtheoretical Model of Change in a number of different areas (Prochaska, Velicer et al., 1994). The pros and cons components emerged as the only components from the principal components analysis. Coefficient alphas for each scale have also demonstrated the reliability of this instrument.

The findings of the current study suggest that CAD is applicable for various occasions including treatment admission, discharge, and post-treatment follow-up. In addition to classifying individuals into various stages of change through cluster analyses (e.g., McConnaughy et al., 1983, 1989), previous studies have used the original version of CAD, the URICA, to assess treatment outcome and progress based on changes on each scale (Prochaska & DiClemente, 1992). Future studies should further assess the application of CAD by comparing various methods to assess stages of change. The application of the Transtheoretical Model of

Change is highly dependent upon whether stages of change can be accurately assessed. Study 2 focused on examining various methods of using the CAD to assess stages of change among clients in substance abuse treatment.

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Table 1-1 Change Assessment for Drug Use (CAD): Final 16 items and Loadings based on Exploratory Sample (n=304)

CAD Scales / Items	Components			
Precontemplation	**I**	**II**	**III**	**IV**
11. Working on problems is pretty much of a waste of time for me because the problem doesn't have to do with me.	.80			
23. I may be part of the problem, but I don't really think I am.	.75			
13. I guess I have faults, but there's nothing that I really need to change.	.73			
5. I'm not the problem one. It doesn't make much sense for me to be here.	.60			
II. Contemplation				
24. I hope that someone will have some good advice for me.		.76		
8. I've been thinking that I might want to change something about myself.		.72		
15. I have a problem and I really think I should work on it.		.70		
21. Maybe someone will be able to help me.		.69		
III. Action				
7. I am finally doing some work on my problem.			.84	
30. I am actively working on my problem.			.82	
14. I am really working hard to change.			.80	
3. I am doing something about the problems that had been bothering me.			.78	
IV. Maintenance				
18. I thought once I had resolved the problem I would be free of it, but sometimes I still find myself struggling with it.				.72
32. After all I had done to try and change my problem, every now and again it comes back to haunt me.				.67
16. I'm not following through with what I had already changed as well as I had hoped, and I'm working to prevent a relapse of my problem.				.67
28. It is frustrating, but I feel I might be having a recurrence of a problem I thought I had resolved.				.64

Note: Varimax Rotation

Table 1-2 Change Assessment for Drug Use (CAD): Factor Loadings and Error Variance of the Final 16 items obtained from Confrimatory Factor Analysis based on Exploratory Sample (n=304)

CAD Scales	Factor Loadings	Error Variance
I. Precontemplation		
11. Working on problems is pretty much of a waste of time for me because the problem doesn't have to do with me.	.80	.26
23. I may be part of the problem, but I don't really think I am.	.63	.25
13. I guess I have faults, but there's nothing that I really need to change.	.61	.25
5. I'm not the problem one. It doesn't make much sense for me to be here.	.45	.27
II. Contemplation		
24. I hope that someone will have some good advice for me.	.61	.25
8. I've been thinking that I might want to change something about myself.	.69	.24
15. I have a problem and I really think I should work on it.	.67	.24
21. Maybe someone will be able to help me.	.67	.24
III. Action		
7. I am finally doing some work on my problem.	.82	.20
30. I am actively working on my problem.	.76	.21
14. I am really working hard to change.	.73	.22
3. I am doing something about the problems that had been bothering me.	.76	.21
IV. Maintenance		
18. I thought once I had resolved the problem I would be free of it, but sometimes I still find myself struggling with it.	.58	.27
32. After all I had done to try and change my problem, every now and again it comes back to haunt me.	.52	.27
16. I'm not following through with what I had already changed as well as I had hoped, and I'm working to prevent a relapse of my problem.	.52	.27
28. It is frustrating, but I feel I might be having a recurrence of a problem I thought I had resolved.	.59	.27

Table 1-3 Model Comparisons using CFA of the Change Assessment for Drug Use Scale

Model Comparisons	χ^2	df	RMSR	GFI	CFI	PFI
Null	1398.80	120	0.232	0.52	___	___
1-factor	712.55	104	0.142	0.73	0.52	0.45
2-factor, uncorrelated (PC+C, A+M)	506.81	104	0.145	0.81	0.69	0.60
2-factor, correlated	571.28	103	0.131	0.80	0.63	0.54
3-factor, uncorrelated (PC, C+A, M)	414.62	104	0.134	0.84	0.76	0.66
3-factor, correlated	376.63	101	0.097	0.85	0.78	0.66
4-factor, uncorrelated	362.35	104	0.148	0.87	0.80	0.69
4-factor, correlated	229.00	98	0.062	0.92	0.90	0.75
1-hierarchical factor	238.08	100	0.068	0.91	0.89	0.74

Note: Model comparisons indices -

1. RMSR: Root mean squared residuals
2. GFI: Goodness of fit index
3. CFI: Comparative fit index
4. PFI: Parsimony fit index (based on CFI)

Table 1-4 Change Assessment for Drug Use (CAD): Factor Loadings and Error Variance obtained from Confrimatory Factor Analysis based on Confirmatory Sample (n=298)

CAD Scales	Factor Loadings	Error Variance
I. Precontemplation		
11. Working on problems is pretty much of a waste of time for me because the problem doesn't have to do with me.	.81	.24
23. I may be part of the problem, but I don't really think I am.	.53	.25
13. I guess I have faults, but there's nothing that I really need to change.	.58	.26
5. I'm not the problem one. It doesn't make much sense for me to be here.	.66	.24
II. Contemplation		
24. I hope that someone will have some good advice for me.	.59	.25
8. I've been thinking that I might want to change something about myself.	.54	.26
15. I have a problem and I really think I should work on it.	.53	.26
21. Maybe someone will be able to help me.	.60	.25
III. Action		
7. I am finally doing some work on my problem.	.80	.20
30. I am actively working on my problem.	.76	.21
14. I am really working hard to change.	.75	.21
3. I am doing something about the problems that had been bothering me.	.71	.22
IV. Maintenance		
18. I thought once I had resolved the problem I would be free of it, but sometimes I still find myself struggling with it.	.53	.27
32. After all I had done to try and change my problem, every now and again it comes back to haunt me.	.62	.28
16. I'm not following through with what I had already changed as well as I had hoped, and I'm working to prevent a relapse of my problem.	.33	.27
28. It is frustrating, but I feel I might be having a recurrence of a problem I thought I had resolved.	.57	.28

Table 1-5 CAD (The Change Assessment for Drug Use): mean, Standard Deviations, Coefficient Alphas & Scale Correlations at Baseline, N=617

Scales (number of items)	M	SD	Alpha	Correlations PC	C	A	M	Social Desirability
Precontemplation (4)	17.64	2.48	.57	1.00				.02
Contemplation (4)	17.66	2.06	.69	-.40*	1.00			.02
Action (4)	16.84	2.43	.73	-.30*	.57*	1.00		-.12*
Maintenance (4)	15.22	2.79	.57	-.12*	.33*	.22*	1.00	.14*
CAD - all items (16)	67.36	6.79	.80	.64*	.79*	.73*	.64*	.03

PC items reverse-scored

Note: 1. Scale scores range from 4 to 20; CAD scores range from 16 to 80.

2. All PC items are reverse-scored

* $p < .01$

Table 1-6 CAD (The Change Assessment for Drug Use): mean, Standard Deviations, Coefficient Alphas & Scale Correlations at *Exit (discharge), N=438

Scales (number of items)	M	SD	Alpha	Correlations PC	C	A	M	CAD
Precontemplation (4)	17.14	3.11	.75	1.00				
Contemplation (4)	16.93	2.59	.75	-.45*	1.00			
Action (4)	17.12	2.91	.83	-.42*	.73*	1.00		
Maintenance (4)	13.96	2.90	.56	-.05	.34*	.22*	1.00	
CAD - all items (16)	65.16	8.36	.85	.68*	.86*	.82*	.55*	1.00

PC items reverse-scored

Note: 1. Scale scores range from 4 to 20; CAD scores range from 16 to 80.

2. All PC items are reverse-scored

* $p < .01$

Table 1-7 CAD (The Change Assessment for Drug Use): mean, Standard Deviations, Coefficient Alphas & Scale Correlations at *Follow-up (3-month post discharge) N=602

Scales (number of items)	M	SD	Alpha	Correlations PC	C	A	M	CAD
Precontemplation (4)	16.92	2.91	.72	1.00				
Contemplation (4)	16.52	2.39	.72	-.27**	1.00			
Action (4)	15.83	3.33	.85	-.22**	.34**	1.00		
Maintenance (4)	14.26	2.96	.62	-.10*	.32**	.03	1.00	
CAD - all items (16)	63.52	7.53	.85	.63**	.71**	.67**	.55**	1.00
***PC items reverse-scored**								

Note: 1. Scale scores range from 4 to 20; CAD scores range from 16 to 80.

2. All PC items are reverse-scored

* $p < .05$

** $p < .01$

Table 1-8 Decisional Balance Scale for Drug Use: Items and loadings

Scales / Items	Component I	Component II
Pros		
I feel more confident when I use drugs.		.85
Drugs make me feel more confident and sociable.		.84
I feel better about myself while using drugs.		.76
Drugs give me that extra boost of energy.		.73
Drugs help me relieve tension.		.72
I am more fun to be with when I use drugs.		.71
Cons		
Buying drugs has contributed to my experiencing some financial strain.	.71	
When using drugs I fail to keep up with bills.	.70	
When using drugs, I borrow money that I fail to pay back.	.67	
As I became more involved with drugs, I pulled away from people I was once close to.	.64	
My drug use has led me to act irresponsibly.	.56	
I experience sleeping problems when I use drugs.	.51	

Table 1-9 Decisional Balance Inventory: Alphas across Admission, Discharge and Follow-up (All subjects)

Scales (number of items)	Admission (n=636)	Discharge (n=449)	Follow-up (n=621)
Pros (6)	.86	.85	.86
Cons (6)	.71	.77	.83

Table 1-10 Pearson Correlation Coefficients among Change Assessment for Drug Use (CAD), Decisional Balance for Drug Use, Self-Efficacy for Avoiding Drug Use and Social Desirability at Baseline

	PC	C	A	M	CAD	PROS	CONS	Self-Efficacy	Social Desirability
CAD subscales									
PC	1.00								
C	-.40*	1.00							
A	-.30*	.56*	1.00						
M	-.12*	.33*	.22	1.00					
CAD	.64*	.78*	.73	.64*	1.00				
Decisional Balance for Drug Use									
PROS	-.25*	.26*	.16	.23*	.32*	1.00			
CONS	-.04	.10*	-.06	.17*	.09*	.13*	1.00		
Self-Efficacy for Avoiding Drugs	-.01	-.03	.10	-.13*	-.02	-.08*	-.20**3	1.00	
Social Desirability	-.02	.03	-.11	.15*	.04	.20*	.32**	-.23**	1.00

*p < .05

**p < .01

Table 1-11 Pearson Correlation Coefficients among Change Assessment for Drug Use (CAD), Decisional Balance for Drug Use, and Self-Efficacy for Avoiding Drug Use at Exit

	PC	C	A	M	CAD	PROS	CONS	Self-Efficacy
CAD subscales								
PC	1.00							
C	-.45*	1.00						
A	-.42*	.73*	1.00					
M	-.05	.34*	.22*	1.00				
CAD	.68*	.86*	.82*	.55*	1.00			
Decisional Balance for Drug Use								
PROS	.14*	-.05	-.15*	.22*	-.05	1.00		
CONS	-.31*	.43*	.42*	.19*	.46*	.01	1.00	
Self-Efficacy for Avoiding Drugs								
	-.07	.12	.30*	-.04	.15*	.04	-.32*	1.00

*$p < .05$

**$p < .01$

Table 1-12 Pearson Correlation Coefficients among Change Assessment for Drug Use (CAD), Decisional Balance for Drug Use and Self-Efficacy for Avoiding Drug Use at Follow-up

	PC	C	A	M	CAD	PROS	CONS	Self-Efficacy
CAD subscales								
PC	1.00							
C	-.27*	1.00						
A	-.22*	.34*	1.00					
M	-.10*	.32*	.03	1.00				
CAD	.63*	.71*	.67*	.55*	1.00			
Decisional Balance for Drug Use								
PROS	-.05	-.03	-.24*	.13*	-.09*	1.00		
CONS	-.30*	.28*	.17*	.15*	.35*	.15*	1.00	
Self-Efficacy for Avoiding Drugs								
	.06	.03	.55*	-.18*	.21*	-.01	-.36*	1.00

*$p < .05$

**$p < .01$

STUDY 2 ASSESSING STAGES OF CHANGE AMONG DRUG ADDICTS IN TREATMENT

Introduction

Research in substance abuse treatment retention and outcome has been hampered by the lack of standardized assessment measures. Specifically, investigators have started focusing on dynamic, non-traditional characteristics of clients in the hope for further understanding the treatment process of substance abuse (e.g., Condelli & DeLeon, 1993). The Transtheoretical Model of Change (Prochaska & DiClemente, 1982, 1984, 1992), which has been successfully applied across a number of behavioral change areas, offers a promising systematic framework to assess individuals intentions, attitudes and behaviors regarding changing a behavior. The key of applying the Transtheoretical Model of Change to the area of substance abuse is to first accurately assess stages of change. Stages of change is a temporal constellation of an individual's intention, attitudes and behavior related to change. Assessment of stages of change can be achieved through a discrete categorical algorithm or a continuous measure (Prochaska & DiClemente, 1992). The categorical stage assessment involves a stage algorithm which consists of dichotomous questions to assess the person's readiness for change, or a series of statements describing each different operational definition of stages. Previous studies have applied similar forms of stage algorithm to assess stages of change in cocaine use and other drug use (e.g., Rosenbloom, 1991; Tsoh, 1993). However, several problems have been noted in applying the stage algorithm to drug addicts in treatment such as the high tendency of over-classifying individuals in treatment in action or maintenance (see Study 1). When compared to the assessment of stages using a continuous measure, the University of Rhode Island Change Assessment Scale (URICA; McConnaughy, Prochaska, & Velicer, 1983), stage algorithm was

shown to be less capable in producing distinguished stages of change (Tsoh, 1993). The Change Assessment for Drug Use (CAD) was developed in Study I targeting the stages of change among drug addicts who are in treatment.

In order to determine individuals' stages of change using a continuous measure, a cluster analytic procedure has been used as the staging method. Owing to the complexity of cluster analysis, researchers have recently suggested using other methods to classify individuals into different stages based on their scale scores (see below). The purpose of this study was to compare and evaluate each of the stage allocation methods, to arrive at the "best" method for applying this instrument among drug abusers, as well as to establish stage membership of subjects for further analyses.

Methods of Stage allocation using the Stages of Change Assessment Scale

Cluster analysis This stage allocation method involves grouping individuals on their profiles of these four scales: Precontemplation, Contemplation, Action, and Maintenance of the Change Assessment Scale. Cluster analysis is used in order to classify subjects into subgroups based on the similarities they share on their responses to the Stages of Change Scale. It requires the scale scores to be converted into standardized T-scores with a mean of 50 and a standard deviation of 10. The number of clusters is determined by interpretability of distinct clusters, visual inspection of the cluster dendrogram (Aldenderfer & Blashfield, 1984), as well as the Cubic Clustering Criteria (Sarle, 1983; Milligan & Cooper, 1985). The resulting profiles from the cluster analyses were compared to the those obtained from previous studies using the same procedure in substance abuse as well as in other areas (e.g., DiClemente & Hughes, 1990; McConnaughy, et al., 1983, 1989; Tsoh, 1993).

Highest Score Methods In applying a 12-item stages of change scale developed among excessive drinkers in medical settings and who were not seeking treatment for alcohol, Rollnick,

Heather, Gold and Hall (1992) proposed a "Quick Stage Allocation Method". The scale was modified from the original 32-item URICA especially for that population. Three factors were validated: Precontemplation, Contemplation and Action. Stage assignment is based on the highest raw scale score obtained among the three scales. In case of a tie between two scale scores, the one further along the continuum of the stages of change is chosen. Item scores range from -2 (strongly disagree) to 2 (strongly agree). Rollnick and colleagues (1992) found that using standardized item means yielded similar results as using raw scores. In this study, the use of both raw and standardized scores were evaluated. Stage assignment was based on the highest mean scores among the four scales of CAD (Precontemplation, Contemplation, Action & Maintenance) refined in Study I. For simplicity purposes, the stage allocation methods are named as Highest Raw Score and the High Z-score Method (when a standardized score is used).

Profile Score Methods This approach allocates stages based on pre-assigned profiles across the scales. Using the 3-scale Stages of Change measure, Rollnick and colleagues (1992) allocated stages based on some "pre-assigned" profiles. Each scale has a mean ranged from -2 to +2, and they assigned "+" (mean value of agree to strongly agree) or "-"(mean value of disagree to strongly disagree) to each scale. Each of the stages to be allocated has a "pre-assigned" profile of scales scores across the 3 scales of PC, C & A: Precontemplation stage "+--"; Contemplation stage "-+-"; Preparation stage "-++ with C > A"; and Action stage "-++ and C < A". Other profiles were considered as invalid or uninterpretable. Stages allocated using this approach outweigh the Highest Raw Score Method (Rollnick et al., 1992) in predicting follow-up outcome.

In this study, new "pre-assigned" profiles were used because the Stages of Change scale has four scales instead of three. Item scores were transformed linearly from " 1 - 5" to "-2 - +2" and scale means were coded to "+" (mean greater than 0) or "-" (negative scores of mean of 0).

The following "pre-assigned" profiles across all four scales (PC, C, A, & M) of each stage were proposed: Precontemplation stage "+,-,-,-"; Contemplation stage "-,+,-,+/-"; Preparation stage "-,+,+,-"; Action stage "-,+,+,+" with A < M; and Maintenance stage "-,+,+,+" with M > C, A. Individuals were assigned to one of the five stages based on the above profiles and other profiles were considered as invalid.

Using the above pre-assigned profiles, a similar stage reallocation method using z-score instead of raw score was examined. Each scale score was transformed into z-score, scale means were coded to "+" or "-" according to the sign of the score ("+" if z-score is equal to or above 0 - the mean, and "-" if z-score was negative/less than 0)

Method

Participants

Seven hundred and ten (30% female) clients seeking drug addiction treatment from two drug-free residential settings participated in the study. One residential setting focused on cognitive-behavioral relapse prevention treatment program. Clients who sought treatment between June 1991 to August 1993 were randomized into a 3-month or a 6-month program regardless of their participation in the study. The other treatment setting was a therapeutic community, and similarly, clients were randomized into a 6-month or a 12-month programs. All clients were detoxified and free from withdrawal when they were presented to treatment. Data were collected at admission, discharge and 3-month post-discharge. They received $15 for interviews at admission and discharge, and $25 for the follow-up interview. Admission data were collected with the first week after admission, exit data were collected 7 days before anticipated discharge date to 3 weeks post-discharge, and finally follow-up data were collected between 2 to 6 months after discharge. The current investigation focused on data at baseline only. Table 2-1 presents characteristics of participants. Seventy-two individuals were excluded

due to incomplete data. Therefore, data analyses were based on data from the 638 individuals who provided complete data on all CAD scales.

Measures

Addiction Severity Index (ASI)

The Addiction Severity Index (ASI) (McLellan, Luborsky, Woody, & O'Brien, 1980; McLellan et al., 1985; McLellan et al., 1992) is a semistructured interview that collects data from substance abusers in seven problems areas: medical, employment, legal, alcohol, drug use, family-social functioning, and psychological status. The primary goal of developing the ASI was to provide an instrument to assess treatment outcomes over a broad range of potential areas which could be affected by substance abuse treatment and can be applied across different treatment settings (McLellan et al., 1992). The latest version, the fifth edition of the ASI was used (McLellan et al., 1992), with the addition of questions on personal and family psychiatric history. ASI covers general sociodemographics, as well as past and present information of each area. Composite scores can be computed from each area.

ASI is the most widely used clinical and research instrument in the area of substance abuse. The instrument has been validated across hundreds of studies during the past 14 years across different populations of substance abusers (e.g. Brown, Alterman, Rutherford, Cacciola & Zaballero, 1993; Hendriks, Kaplan, Limbeek, & Geerlings, 1989; Hodgins & Guebaly, 1992; McLellan et al., 1992). Studies in the area of substance abuse have frequently used ASI scale scores for evaluation treatment efficacy and to validate newly developed scales for this area (e.g., Darke, Ward, Zador, & Swift, 1991; Kang, Klinman, Woody, & Millman., 1991; Kosten, Rounsaville & Kleber, 1987).

Change Assessment of Drug Use (CAD)

This 16-item questionnaire refined in Study I was used to assess subjects' readiness to change their problem behavior. Subjects were asked to respond on a 5-point Likert Scale ranging from 1= strongly disagree to 5=strongly agree. Four items comprised each of the four stages of change: Precontemplation (PC), Contemplation (C), Action (A) and Maintenance (M). This measure was administered at both admission and discharge interviews. The psychometric properties of the measure have been demonstrated in Study I with coefficient alphas ranging from .57 to .73 at baseline and .56 to .83 at exit. The application of the measure in assessing stages of change of drug use was examined in this study.

Decisional Balance Inventory

The 12-item scale modified from the Cocaine Decisional Balance Inventory (Rossi, Rosenbloom, et al. 1993) was used. With some wording changes replacing "cocaine use" with "drug use", this 12-item version has been shown to be a valid measure for the decisional balance construct in a sample of drug addicts in treatment (Tsoh, 1993). Subjects were asked to rate each item on a 5-point Likert scale ranging from 1= not important to 5= extremely important. The items represent PROS and CONS for drug use with 12 items on each dimension. The psychometric properties of this measure was further examined in the present study. Items of the measure are shown in Appendix C.

Self-efficacy to avoid drugs

This self-efficacy scale contains 5 items assessing subjects' confidence in their ability to avoid drug use in high risk situations during the next 3 months. Subjects were asked to respond on a four point Likert Scale: 1=extremely confident to 4=not at all confident. Total score is the sum of all 5 items reverse scored, with the higher total score indicating higher confidence. The scale was developed based on the data collected in this study at admission through various

versions of the instrument with an item pool of 11 or 24 items. The factor structure was refined using the shorter version (n=370) and was confirmed using the long version (n=217). The internal consistency as indicated by Cronbach's alpha, was .82 (Rubin, 1993). Items are shown in Appendix D.

Rosenberg Self-Esteem Scale

It contains 10 items assessing individuals' sense of self-worth, satisfaction with self, and belief in their own capabilities. Each item is scored on a four-point scale with 1=strongly agree and 4=strongly disagree. Test-retest reliability and validity in use with adolescent and young adult populations has been adequate (Rosenberg, 1965). Improved in self-esteem is a favorable outcome particularly for those in therapeutic communities.

Beck Depression Inventory

It is a 21-item self-administered questionnaire developed by Aaron Beck (1967). The number and severity of current depressive symptoms are assessed. Adequate reliability has been established in studies of psychotherapy.

Shipley-Institute of Living Scale

It is a self-administered test of cognitive functioning (Shipley, 1939). It contains a verbal and an abstract section. Scores are age-corrected and can be converted to an estimated WAIS-R IQ score with mean=100, SD=15. The estimated WAIS-R IQ score was used in the current study. Administration of the instrument was timed and subjects were allowed 15 minutes to complete each section.

Diagnostic Interview Schedule, Third Edition Revision (DIS-III-R)

An abbreviated version of the DIS-III-R which incorporates items for the DSM-III-R diagnostic criteria (American Psychiatric Association, 1987) was used. Only questions needed to ascertain some pre-selected DSM-III-R diagnoses were asked. Those diagnoses include panic

disorder, social phobia, major depressive disorder, dysthymia, alcohol abuse and alcohol dependence, antisocial personality disorder, and pathological gambling. The decision to focus on these diagnoses was based on considerations of prevalence of these disorders among drug abusers in treatment and evidence that particular disorders may be associated with treatment outcomes.

Social Desirability Scale

Jackson's Social Desirability Scale (Jackson, 1967) was used to assess response bias due to social desirability. This instrument consists of 20 items that are presented in a true-false format. It has been found to be a valid and reliable measure to determine if a response set tends toward the direction of social desirability.

Other variables

Data on other variables that have been associated with outcomes or retention from previous studies were also collected. Those variables included HIV status, sources of referrals, length of stay in treatment, and status of completion.

Data Analysis

The best stage allocation method was expected to be able to classify subjects into various stages of change that could be distinguished easily by relevant variables such as the Decisional Balance Scales, and Self-Efficacy in an interpretable manner. Each method was evaluated by the following criteria:

i. proportion of subjects classified successfully;

ii. validation against decisional balance (pros and cons), and self-efficacy to avoid drugs using MANOVA and follow-up ANOVA;

iii. correct classification rate using pros, cons, and self-efficacy as predictors for stage membership from Discriminant Function Analysis (DFA).

After the best stage allocated method was selected, agreement on stage memberships with the best method and other methods was assessed. Furthermore, the use of the Change Assessment Scale for Drug Use (CAD) was examined. Validation of CAD total score was conducted using one-way ANOVA to examine the capability of CAD score to separate different stages based on the best method of stage allocation found in this study. Lastly, relationships between stages of change (using the best stage allocation method) and the ASI measures, as well as other sociodemographic variables at baseline were examined.

Results

Cluster Analysis

The four scales, PC, C, A & M of the CAD were used as clustering variables. Scale statistics of the whole sample (n=638) with complete data on all the four CAD scales indicated that there were 5 individuals with at least one or more CAD scales in the range beyond ± 4 SDs'. These outliers were excluded since outliers can yield unstable cluster profiles (SAS, 1985). Participants were randomly split into two independent samples (Sample 1: n=310; Sample 2: n= 324) for cross validation of resulting cluster profiles. Sample characteristic comparisons indicated the two samples were very similar and would serve well for validation purposes. Scale scores were the means of the item scores for each scale, which were converted into standardized T-scores with a mean of 50 and a standard deviation of 10. Scale scores were standardized in each sample and cluster analysis was performed on each sample independently. Individuals were classified into cohesive subgroups based on the similarities they shared on their responses to the CAD scales. Ward's minimum variance method (Ward, 1963) was used as it has been demonstrated to be the most desirable method among other cluster analytic procedures (Milligan, 1980; Milligan & Cooper, 1987). Using Ward's procedure, each subject was treated as an individual cluster and then the clusters are merged into subgroups. The Euclidean distance

measure of similarity was calculated for merging clusters with the smallest distance. Finally, the number of clusters was determined by interpretability of distinct clusters, visual inspection of the cluster dendrogram (Aldenderfer & Blashfield, 1984), as well as the Cubic Clustering Criteria (Sarle, 1983; Milligan & Cooper, 1985).

In Sample 1, solutions of 4 to 10 clusters were considered. The 6-cluster solution was the most interpretable. The clusters were labeled: Uninvolved (n= 48), Precontemplation (n=60), Reluctant (n=32), Contemplation (n=78), Preparation (n = 40), and Action (n = 52). In Sample 2, a 6-cluster solution was found most interpretable among the range of 4 to 10-cluster solutions considered. The cluster profiles were very similar to those identified in Sample 1 with respect to level, scatter and shape. The distribution for each clusters were: Uninvolved (n=49), Precontemplation (n=73), Reluctant (n=26), Contemplation (n=76), Preparation (n=50), and Action (n=49). The means and standard deviations for the scale scores of each cluster for Samples 1 & 2 are shown in Table 2-2 & Table 2-3 respectively. Each cluster profile is described below.

Uninvolved Cluster: This subgroup consisted of 15.5% (n=48) of Sample 1 and 15.2% (n=49) participants of Sample 2 were classified into this cluster. Both profiles were characterized by below to about average scores on the PC scale and well below average score on the C, A and M scales (Figure 2-1). Individuals in this cluster were not actively participating in changing or considering about quitting drugs. They seemed to deny their drug use as a problem and seemed to be "uninvolved" with treatment for drug use. This profile represents a "lack of endorsement" of most scales.

Precontemplation Cluster: This subgroup consisted of 19.4% (n=60) and 22.6% (n=73) of Samples 1 & 2 respectively. These individuals featured an elevated score on PC and below to about average on C, A & and M scales (Figure 2-2). Individuals in this cluster were not

considering or actively engaging in quitting drugs; rather they seemed to deny their drug use as a problem and maintained the status quo with respect to their drug use.

Reluctant Cluster: This subgroup consisted of 10.3% (n=32) and 8.0% (n=26) of Samples 1 & 2 respectively. This typology indicated a lack of action profile. Individuals were characterized by an about average score on PC, C & M scales and an extremely below average score on the A scales. They seemed to recognized their drug use as a problem and/or even began to consider changing, yet they were reluctant to make commitment to change or to participate in treatment. Figure 2-3 presents the profiles of this cluster identified in the two samples.

Contemplation Cluster: The 25.2% (n=78) and 23.5% (n=76) participants of Samples 1 and 2 respectively comprising this cluster showed a below average of PC scale and about average of C, A & M (Figure 2-4). These individuals had recognized drug use as a problem and were thinking about changing. However, they had not yet actively engaging in quitting.

Preparation Cluster: There were 16% (n=52) of Sample 1 and 15.2% (n=49) of Sample 2 participants classified into this cluster. The cluster profile was characterized by a below average endorsement on both PC and M scales, and above average on the Contemplation and Action scales (Figure 2-5). These subjects have made a decision to change their drug use behavior and have started actively participating in changing. However, they have not yet experienced or recognized the risks of relapse (low endorsement of M).

Action / Participation Cluster: The 12.9% (n=40) and 15.5% (n=50) of Samples 1 and 2 individuals respectively classified into this cluster were characterized by below average scores on PC, but well above average scores on C, A and M scales (Figure 2-6). These individuals reported high investment and involvement in changing their drug use behavior, and have started to maintain their behavior change and work toward preventing relapse.

The converging results from the cluster analyses conducted in two independent samples indicating that the cluster profiles identified in each sample was very similar and that the cluster solution obtained was stable. Therefore, the external validation of clusters were proceeded with two samples combined retaining the cluster membership derived from each sample. Table 2-4 presents the distribution of clusters across each sample and the combined sample.

External validation of clusters with decisional balance and self-efficacy measures

A one-way MANOVA was conducted using the stage clusters as the independent variable on three variables including the Pros and Cons for drug use and self-efficacy to avoid drugs,. The MANOVA yielded a significant main effect, Wilks' $\Lambda = .85$, $F(15, 1725.75) = 6.80$, $p < .001$, which accounted for 15% of the variance. Follow-up ANOVAs were conducted for each of the three scales to determine group differences. Significant main effects were found on all measures. Summaries of the follow-up univariate tests and the Tukey post-hoc tests are presented in Table 2-5. On the Pros for drug use, both Reluctant and Action clusters scored significantly higher than individuals in Preparation, and Action cluster has a higher Pros than Contemplation and Uninvolved clusters. On the Cons for drug use, the Action cluster endorsed significantly higher scores than all others; the Contemplation cluster was similar to the Preparation cluster whereas subjects in the Precontemplation and Uninvolved clusters scored significantly lower than Contemplation clusters. With respect to Self-efficacy, the Preparation and Uninvolved clusters reported higher self-efficacy as compared to Contemplation, while the clusters of Precontemplation, Reluctant and Action did not differ significantly from others in this measure. Figure 2-7 and Figure 2-8 illustrate the mean values for the Pros and Cons scales of the Decisional Balance for Drug use and Self-efficacy across clusters respectively.

A stepwise discriminant function analysis (DFA) was performed using the three measures, Pros, Cons and Self-efficacy as predictors for the cluster membership. Two

significant discriminant functions were obtained. Cons was the primary predictor (loading = .93) for function 1 with Wilks' $\Lambda = .87$, χ^2 (10) = 84.73, $p < .0001$, Canonical correlation (R_c^2) = .32. Function 2 consisted of Pros as the primary predictor (loading = .89) with Wilks' $\Lambda = .98$, χ^2 (4) = 15.24, $p < .005$, $R_c^2 = .15$. The inter-group variability as accounted for function 1 (Cons) and function 2 (Pros) were 82.65% and 17.35% respectively. The jackknifed classification analysis showed that 24.0% (as compared to 16.7% by chance alone) of the 633 participants were correctly classified into one of the 6 clusters. The most accurate classification occurred in the Action cluster, where 53.3% of the sample was correctly classified, while the most misclassification occurred in Precontemplation cluster, in which only 5.4% was correctly classified with most participants (31.6%) classified into the Uninvolved cluster.

Highest Raw Score Method

Of the 638 individuals providing complete responses to CAD, stage membership was allocated according to the CAD scale with the highest raw score, and in case of ties, a more "advanced" stage was assigned. Analysis yielded the following stage distribution: 0.6% (n=4) in Precontemplation, 38.7% (n=247) in Contemplation, 39.0% (n=249) in Action, and 26.1% (n=138) in Maintenance. The exceptionally small portion of precontemplators classified by this allocation method indicated a questionable capability in classifying individuals into Precontemplation. Therefore, no further external validation of the method was performed.

Highest Z-score Method

Scale scores of each CAD subscales were standardized to the mean of 50 with a standard deviation of 10 based on the 638 participants provided complete data. Stage membership was allocated according to the CAD scale with the highest standardized score, similar to the allocation method using raw scores, in case of ties, a more "advanced" stage was assigned. Of the 638 participants, stage allocation method yielded the following stages of change (Stage-z)

distribution: 26.2% (n=167) in Precontemplation, 25.4% (n=162) in Contemplation, 21.1% (n=135) in Action, and 27.3% (n=174) in maintenance.

External validation of stages with decisional balance measures

A one-way MANOVA using Stage-z as the independent variable was performed on the Pros, Cons and Self-efficacy as dependent variables. The mean of the item scores of each scale was used as scale scores for the analysis. Results showed a significant main effect, Wilks' Λ = .90, $F(9, 1538.3) = 7.79$, $p < .001$, which accounted for 10% of the variance. Follow-up univariate analyses (ANOVA) were conducted for each of the four scales to determine group differences for validating the stages based on this stage allocation method (Table 2-6). Significant main effects were found in all variables. Tukey post-hoc test on Cons for drug use indicated that Precontemplators scored significantly lower than all other stages. On the Pros for drug use, individuals in Maintenance were found to have a higher score than those in Action with no other significant difference observed between any other two groups. Individuals in Precontemplation and Action were noted to have significantly higher self-efficacy to avoid drug use than both contemplators and maintainers. Figure 2-9 & Figure 2-10 illustrate the mean values for the Pros and Cons scales of the Decisional Balance for Drug Use and Self-efficacy across stages respectively.

A stepwise discriminant function analysis (DFA) was conducted using Pros, Cons and Self-efficacy as predictors for the stages of change. Two significant discriminant functions were obtained. Cons was the primary predictor (loading = .84) for function 1 with Wilks' $\Lambda = .90$, $\chi^2 (9) = 68.76$, $p < .0001$, Canonical correlation (R_c^2) = .29. Function 2 consisted of Pros as the primary predictor (loading = -.66) with Wilks' $\Lambda = .98$, $\chi^2 (4) = 13.16$, $p < .01$, $R_c^2 = .14$. The inter-group variability accounted for by function 1 (Pros) and function 2 (Cons) were 81.38% and 18.50% respectively. The jackknifed classification analysis showed the overall correct

classification rate was 34.6% (as compared to 25.0% by chance alone). The most accurate classification occurred in Precontemplation, where 46.1% of the sample was correctly classified. However, the most misclassification occurred in Contemplation, in which only 4.9% was correctly classified with most participants (42.0%) misclassified into Maintenance.

Profile Raw Score Method

Each CAD scale score was transformed into a range from -2 to +2 from a possible range of 1 to 5, and further coded into "+" or "-" according to the sign of the score. Stage membership was allocated according to the pre-assigned profile as mentioned above. Of the 638 individuals, 216 (33.96%) could not be staged due to invalid profiles, i.e. profiles that did not match any of the pre-assigned profiles. Table 2-7 presents 4 alternative profiles that could not be assigned with a stage based on this method. The majority of unstageable subjects presented a profile of "-,+,+,+" with highest score on C. Of the remaining individuals (n=422), analysis yielded the following stage distribution: 0.4% (n=2) in Precontemplation, 6.2% (n=26) in Contemplation, 6.2% (n=26) in Preparation, 57.6% (n=243) in Action, and 29.6% (n=125) in maintenance. Similar to the Highest Raw Score Method above, majority of subjects were classified into Action or Maintenance stage (over 87%) and only an exceptionally small portion of precontemplators were classified, indicating a questionable capability of this method in classifying individuals into Precontemplation. Furthermore, owing to the large portion of "unstageable" individuals based on the current method, no further external validation of the method was performed.

Profile Z-score Method

Each CAD scale score was transformed into z-score with mean equals 0 and was further coded into "+" or "-" according to the sign of the z-score. Stage membership was allocated according to the pre-assigned profile as mentioned above. Similar to the Profile-R method, more than half of the subjects, 316 (49.5%) could not be staged due to invalid profiles. Table 2-8

presents 11 alternative profiles that could not be assigned with a stage based on this method. More prominent alternative profiles were "-,-,-,-" (15.2%), "+,-,-+" (15.2%) and "+,+,+,+" (14.2%). The remaining individuals (n=322), analysis yielded the following stage distribution: 23.9% (n=77) in Precontemplation, 15.5% (n=50) in Contemplation, 10.0% (n=32) in Preparation, 32.9% (n=106) in Action, and 17.7% (n=57) in maintenance. Owing to the large portion of "unstageable" individuals based on the current method, no further external validation of the method was performed.

Method evaluation

As indicated earlier, the methods of stage allocation were subjected to the following criteria for evaluation purposes including proportion of successful classified subjects; MANOVA results on proportion of variances accounted by pros, cons and self-efficacy; and overall DFA correct classification rate using pros, cons and self-efficacy as predictors. Comparison results including stage distribution produced by each allocation method is shown in Table 2-9. Among the 5 methods of stage allocation, cluster analysis, highest-score methods based on both raw and standardized scores, and pre-assigned profile methods based on both raw and z-scores, only cluster analysis and the highest-z-score methods proceeded with external validation due to failure of other methods in meeting the first evaluation criteria. The highest-raw-score method lacked sensitivity in classifying precontemplators where over 99% were classified into C, A or M. Both pre-assigned profile methods, however, yielded a large portion of unclassifiable cases. Therefore, only the clusters analysis and the highest z-score methods satisfied the first criteria on the capability in successfully allocating most individuals to various stages of change. Therefore, these two methods were subjected to further evaluation by other criteria. Comparison based on the second criteria on MANOVA results (Table 2-9) indicated that the stage allocation method based on cluster analysis yielded a higher amount of intergroup variability accounted by Pros

and Cons for Drug use and Self-efficacy (15% vs. 10%). The correct classification rate using DFA based on pros, cons and self-efficacy as predictors suggested a small difference that favored cluster analysis. By comparing classification to chance alone, the overall correct classification rate of 24 % for 6 clusters was 44% better than by chance alone (16.7%) as compared with the rate of 34.6% for 4 stages (from the highest z-score method) which was 38% better than by chance alone (25%). Although the DFA overall correct classification rates for both methods were quite low but were acceptable (better than chance alone), it should be noted that the classification rates were based on two predictors only.

Comparison of stage memberships derived from cluster analysis and the highest z-score method is presented in Table 2-10. Majority of subjects in the Uninvolved (57%) and the Precontemplation clusters (61%) were classified into the PC stage by the highest z-score method. Most subjects (77%) in the Preparation clusters were in the A stage and majority of the Action cluster individuals were allocated with either the stages of A (31%) or M (56%). The most disagreement, however, occurred in the Reluctant and the Contemplation clusters, in which most Reluctant individuals (45%) were allocated to the stage of C, and most Contemplation cluster subjects (47%) were classified into M stage instead using the highest z-score method. While both methods appeared to be an acceptable method to assess stages of change among individuals seeking substance abuse treatment, the current findings comparing these methods suggested that cluster analysis was a better method. Therefore, stage membership based on cluster analysis was used to proceed with the following analyses.

Relationship between stages and CAD score

CAD score was created by computing the sum of all scale means with the PC scale reverse-scored. A one-way ANOVA was conducted using the stage clusters as the independent variable on the total CAD score. Significant differences across clusters were noted with F

(5,627) = 284.23, $p < .0001$. Follow-up Tukey post-hoc tests indicated that significant differences across all clusters in the following ascending order: Uninvolved, Precontemplation and Reluctant, Preparation, Contemplation, and Action, with the exception of PC and R clusters where both have similar CAD scores Table 2-11.

Relationship between stages and other measures

A series of MANOVA, follow-up ANOVA as well as Chi-square tests were performed on all participant characteristics (see Table 2-1) including types of programs and settings, age, gender, education, treatment history, drug use pattern, legal involvement and so on, 7 composite scores from ASI measures including drug use, alcohol, medical, employment, family and social, legal, and psychiatric status, and other psychological measures including Rosenberg Self-Esteem Scale, Depression (Beck Depression Inventory), psychiatric diagnosis based on the Diagnostic Interview Schedule. No significant differences were found across clusters on demographic variables. However, there were significant differences regarding the types of living-environment before admission, proportion of subjects with social phobia, depression level, self-esteem and the ASI composite score on drug use.

Types of living-environment before admission across clusters are presented in Table 2-12. Significantly more individuals in Preparation (PR) and Action (A) were living in a controlled environment before admission as compared to other clusters χ^2 (5)=14.99, $p < .01$. More specifically, over half of the subjects in Preparation and Action came from detoxification centers before admission as compared to most other clusters χ^2 (5)=16.37, $p < .01$. Of 595 subjects with diagnostic information on social phobia, 33.9% fulfilled the diagnostic criteria of social phobia using the Diagnostic Interview Schedule. There were significantly less PR subjects with social phobia as compared to all other clusters, 17.5% (PR) vs. 35.2% (U), 37.6% (PC), 49.0% (R), 35.6% (C), & 34.1% (A), χ^2 (5)=17.82, $p < .01$.

Table 2-13 summarizes the differences across clusters on other measures including depression, self-esteem, composite score of drug use (ASI). The relationship between each measure and stages of change are discussed below.

Depression and Stages of Change. Follow-up one-way ANOVA on depression level as measured by the Beck Depression Inventory (BDI) across clusters showed that PR cluster has a significantly lower BDI score than PC, R, C, and A clusters, $F(5,614) = 5.62$, $p < .0001$. Owing to the above finding that there were more social phobic individuals in other clusters than in PR, and, depression is a common symptom present in social phobia (e.g., American Psychiatric Association, 1994), a 2(social phobia)x 6 (clusters) ANOVA on BDI scores was performed to further investigate the relationship between depression and cluster/stage membership. Results indicated only a significant main effect on social phobia, $F(1,582) = 51.98$, $p<.001$, with social phobic individuals reporting higher BDI scores. There was no significant main effect on clusters ($F(5,582)=1.88$, $p>0.05$) or interaction effect ($F(5,582)=1.81$, $p>0.05$). Therefore, since there was a significantly smaller portion of PR subjects with social phobia, depression level did not seem to differ across clusters.

Self-esteem and Stages of Change. Follow-up one-way ANOVA on self-esteem level as measured by the Rosenberg Self-esteem Scale across clusters showed that PR cluster has a significantly higher self-esteem score than R, C, and A clusters, $F(5,622) = 5.06$, $p < .0001$. Since low self-esteem has been known as highly associated with depression level (e.g., APA, 1994), and given the finding earlier regarding lower depression level found in PR individuals which in turn may be due to the connection with social phobic diagnosis, an one-way ANCOVA on self-esteem score using depression level (BDI) as covariate was conducted to further examine the relationship between self-esteem and cluster membership. Results indicated that the depression was a significant covariate with self-esteem ($F(1,614)=239.66$, $p<.001$) in the

ANCOVA model and the main effect of cluster member was not significant ($F(5,614)=1.93$, $p>.05$). Therefore, since there were significantly less reported depressive symptoms by PR subjects, self-esteem level did not seem to differ across clusters.

ASI Composite Score of Drug Use and Stages of Change. Follow-up one-way ANOVA on ASI Composite Score of Drug Use across clusters showed that both A and PR clusters have a significantly higher composite score than the U cluster, $F(5,599) = 4.04$, $p < .01$. The derivation of the composite score was based on the number of days reported with drug problems during the last 30 days as well as two items on self-perception of the degree of being troubled by drug problems and the importance of treatment for drug problems. In order to further understand the relationship between the ASI drug use measure and stages of change, additional analyses were performed. An one-way ANOVA on self-perception of the degree of being troubled by drug problems (perceived severity) only showed a significant difference between U and A, with A cluster subjects reported being more troubled by their drug use. On perceived importance of treatment for drug problems, A, PR and R reported higher value of treatment than U, and A was also different from C with A having higher value of treatment. Second, a new composite score was calculated without the scores from the two self-perception items, in other words, this new composite score denoted only the proportion of days using drugs and/or with drug problems. An ANCOVA on this new composite score was conducted using perceived-trouble and perceived-importance as covariates to further examine the relationship between ASI composite score and cluster membership. Results indicated that the two self-perception measures were significant covariates with the new ASI composite score ($F(2,599)=109.70$, $p<.001$) in the ANCOVA model and the main effect of cluster member was not significant ($F(5,599)=0.52$, $p>.05$). Therefore, cluster membership differed in terms of perceived degree of severity of drug problem and perceived importance of treatment for drug

use, rather than the number of days using drugs or associated with drug problems during the previous months.

Discussion

The comparison of stage allocation methods indicated that cluster analysis on standardized scale scores was among the best method with the highest validity. Findings suggested stage assignment should not be based on raw scores of the CAD subscales. The PC scale tends to have a low score (most drug addicts tend to disagree the items) and A & M scales tend to be highly endorsed. Therefore, standardized scores have been recommended when applying a continuous measure of change assessment (e.g., URICA) rather than using raw scores (Prochaska & DiClemente, 1992).

Although the Highest Z-score method appeared to be the second best method for stage allocation, this method seemed to over-classify contemplators to the stage of Maintenance. Moreover, as suggested by the findings in Study 1, the content of the M scale items concentrates mostly on individuals' awareness and concurrent experience of relapse, but does not reflect much on individuals' process and success in sustaining the change. Therefore, the highest score methods (using raw or standardized scores) might tend to over-classify individuals who are aware of relapse (e.g., a good portion of contemplators) into Maintenance (as indicated by the highest endorsement in M). Nonetheless, the highest z-score method might seem to be quite capable of identifying precontemplators. This type of approach seems to have lost the unique advantage of using a continuous measures in identifying cohesive subtypes beyond the five proposed stages. Instead, the stages assigned are limited by the number of scales.

The profile scores approach assessed staged through matching subjects' profiles with pre-assigned profiles, attempted to improve upon the limitations of the highest score approach yet maintained the advantage of identifying stages quickly without using complicated statistical

techniques. However, current findings suggested that both profile methods (raw or standardized scores) were not able to capture enough of the variability of profiles among drug addicts in treatment and only two-thirds to half of the subjects could be staged according to the existing pre-assigned profiles used in this study. Unless an additional comprehensive set of pre-assigned profile conditions is available and tested, it is not recommended to use profile score methods for stage assignment.

Cluster analysis based on standardized scale scores appeared to produce valid stage profiles consistently as shown by previous studies using this method (e.g., Bellis, 1993; McConnaughy et al., 1983; 1989, Martin et al., 1994; Tsoh, 1993). Six clusters were identified among clients admitted to residential substance abuse treatment programs. These profiles were all identified in previous research on drug addicts in treatment as well as on clients seeking psychotherapy (e.g., Martin et al., 1994; McConnaughy et al., 1983; 1989, Tsoh, 1993.) The cluster profiles representing various degree of readiness for change were externally validated by pros and cons for drug use. A classic cross-over of pros and cons across stages were apparent and consistent with previous studies conducted on different problem behaviors (Prochaska et al., 1994). The Strong Principle of changing problem behavior (Prochaska, 1994) that proposes a minimal of 1 SD increase in the Cons of the behavior from stages of PC to A was demonstrated in the current findings. Individuals who were more ready to quit using drugs reported higher Cons of drugs use. On the other hand, those who were more reluctant to quit using drugs indicated higher importance of the Pros. Unexpectedly, while the Action cluster individuals reported the highest Cons of drug use, they also reported high Pros as well. Although they indicated readiness to change and were actively working through quitting, their high level of Pros might suggest that these individuals were not "well-prepared" prior to take action and that they continued to value the benefits of drug use, which might in turn put them at a higher risk of

relapse. Similar findings of a higher pros among Action were found in cocaine use and other drug use (Rosenbloom, 1991; Tsoh, 1993).

In addition, the external validation of the clusters also supported two additional distinct subtypes of precontemplative profiles beyond the "classic" Precontemplation (PC) profile, which were the profiles of Uninvolved (U) and Reluctant (R). All of these precontemplative clusters featured higher pros of drug use than cons and were indicative of the lack of intention to change. Interestingly, although pros of drug use outweighed the cons in all cases, U individuals reported a general lack of concern for both pros and cons (both below the mean). On the other hand, R individuals indicated an above mean of the both pros and cons indicating that they were aware of the cons of drug use, and they valued the pros of drug use even more. This subtype might represent the "rationalizing" type of precontemplators as proposed by DiClemente (1991), where these individuals were well informed about drug use, yet they rationalized the reasons for continuing to use drugs and therefore did not desire to change.

The relationship between various clusters and self-efficacy found in the current study was somewhat unexpected. Generally, a gradual increase of self-efficacy to avoid drug is expected from early stages to later stages (e.g., Action and Maintenance). Although, as pointed out in Study I, subjects' self-efficacy was based on their reported confidence to avoid drug use in the following 3 months, the current assessment of self-efficacy at admission might be inappropriate/irrelevant because all subjects had presented themselves to a minimal of 3-month residential program where their environment was controlled. Under this assumption, subjects should not differ on this dimension, as they would likely be reporting high self-efficacy. However, the current significant differences noted between Uninvolved (U), Preparation (PR) and Contemplation (C) might be indicative of some distinctive characteristics of some of these clusters. The high level of self-efficacy reported by Uninvolved individuals might indeed

represent a special subtype of precontemplators who were not willing to quit drugs because they felt they could stop or avoid using drugs whenever they desired. Because of their reported high self-efficacy to avoid drug use as they thought they had, they did not necessary view their drug use was a problem. On the other hand, PR individuals' high self-efficacy might be related to the fact most of these individuals admitted to the program directly from a controlled environment, mostly detoxification centers. These individuals had just completed detoxification and had not yet tested their ability to avoid drug use in a free environment, therefore they reported high self-efficacy without being aware of or experiencing the risks of relapse.

The use of the Change Assessment of Drug Use (CAD) scale as a continuous measure for degree of readiness was also supported by the current results. The total score of the scale (with PC items reverse-scored) was able to distinguish most clusters in an expected manner, with higher scores indicative of increased readiness for change. It seemed capable of distinguishing the U clusters from the other clusters as well as the other identified precontemplative profiles. Action individuals also reported the highest score than all their peers in other clusters. The total score, however could not distinguish the PC and R clusters. More unexpectedly, contemplators reported higher total CAD score than individuals in PR. Although findings in general were supportive of the use of CAD as a single continuous index for readiness to change, results indicated that a continuous index could potentially lose the specificity in identifying and grouping individuals into cohesive subgroups. Further evaluation of the use of CAD as a continuous index for readiness is necessary and the application and validity of the index remains an empirical question.

To conclude, current results suggested that cluster analysis is the most recommended method to assess stages of change among substance abusers in treatment. Based on the current findings, six distinct subtypes of individual with various stages of readiness to change were

identified among addicts who were seeking treatment. More importantly, current findings indicated that over 45% of the clients who presented themselves to treatment programs were indeed precontemplative, i.e., not intending to change. These results have clearly indicated that an assumption of clients presenting themselves to treatment are all ready to change is false at least 45% of the time. It is not uncommon for treatment providers to "blame" early attrition or unsuccessful treatment outcome on their clients' lack of readiness for treatment or being too resistant to change. It seems the question should instead be whether current treatment programs are "ready" for their clients. Instead of focusing on skill training techniques for "how" to stay off drugs, perhaps, depending on clients' stages of change, substance abuse treatment programs should also increase emphasis on "why" quitting drugs. Lastly, the lack of relationship between stages of change and other demographic and background variables also suggested the uniqueness of stages of change and implied the potential contribution in understanding treatment retention and outcome. The following studies have examined the relationship between stages of change and treatment dropouts, as well as short-term outcome.

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Table 2-1. Participant Characteristics

Demographic Information		
Treatment Setting	**N**	**%**
Residential (3-month)	251	35.3
Residential (6-month)	242	34.1
Therapeutic Community (TC) (6-month)	124	17.5
TC (12-month)	93	13.1
Total		
Referral		
Legal	100	15.1
Self	562	84.9
missing	48	
Gender		
Male	495	69.7
Female	215	30.3
Age		
under 21	31	4.4
21-25	169	23.6
26-30	197	27.8
31-35	188	26.5
36-40	88	12.5
41 or older	37	5.5
missing	2	
Race		
Caucasian	526	74.8
Black	128	18.0
Hispanic	41	5.8
Other	8	1.1
missing	7	
Marital Status		
Single	461	64.9
Married / Living together	48	6.8
Separated	52	7.3
Divorced	122	17.2
Widowed	5	0.7
Missing	22	
Education		
< 12	237	33.4
High school	328	46.8
Some College	102	14.3
College	22	3.1
Post graduate	10	1.4
missing	9	

Table 2-1. Participant Characteristics (cont'd)

	n	%
Yearly Income		
under $5,000	356	50.9
$5,000 - 9,999	67	9.5
$10,000 - 19,999	75	10.7
$20,000 - 29,999	35	5.0
$30,000 - 39,999	49	7.0
$40,000 or over	119	16.9
missing	10	
Employment Status		
Unemployed	265	37.8
Part time	121	17.2
Full time / self employed	316	45.1
Student / Retired	15	2.2
missing	9	
Legal Status		
Waiting charges	225	32.1
Probation / Parole	334	47.7
not applicable	141	20.2
missing	10	
HIV positive		
Yes	27	5.2
No	165	31.9
Not sure	325	62.9
missing	193	
Previous Drug Abuse Treatment		
0	94	13.6
1	115	16.6
2-4	248	35.5
5 or more	237	34.3
missing	19	
Drug of Choice		
Alcohol only	32	4.5
Alcohol and drug	172	24.2
Cocaine only	185	26.1
Heroin only	155	21.8
Polydrug	153	21.5
Other	13	1.8
IV Drug Users ***(used IV during 3 months prior to admission)***		
Yes	295	41.5
No	415	58.5

Table 2-1. Participant Characteristics (cont'd)

Age First Used Drugs		
Under 13	159	23.1
13-17	439	63.8
18-20	61	8.9
21-30	40	5.9
31 or older	1	0.1
missing	22	
Age First Used IV		
Under 13	6	1.5
13-17	46	34.4
18-20	91	8.9
21-30	160	39.1
31 or older	11	2.7
Total	409	
Types of Living Situation before Admission		
Free-living	246	38.9
Detoxification Centers	277	43.8
Jail	99	15.6
Hospital	11	1.7

Table 2-2. Change Assessment Questionnaire for Drug Use (CAD) Scale Scores for Each Clusters: Sample 1 (n=310)

	Raw		Standardized	
Clusters / CAD Scales	**Mean**	**SD**	**Mean**	**SD**
I. Uninvolved				
PC	1.89	0.54	56.77	8.60
C	3.87	0.40	38.00	8.89
A	3.88	0.50	45.39	7.55
M	3.31	0.44	41.02	5.88
II. Precontemplation				
PC	2.16	0.56	61.04	9.64
C	4.26	0.32	46.52	7.05
A	4.21	0.34	48.70	6.28
M	4.06	0.31	53.34	4.46
III. Reluctant				
PC	1.61	0.41	51.52	6.68
C	4.30	0.30	47.60	6.68
A	3.25	0.51	33.65	8.09
M	3.76	0.38	47.81	5.62
IV. Contemplation				
PC	1.16	0.22	42.86	3.67
C	4.57	0.36	53.19	7.92
A	4.10	0.34	48.41	5.32
M	4.13	0.48	53.46	6.49
V. Preparation				
PC	1.36	0.41	46.21	6.24
C	4.58	0.39	53.61	8.71
A	4.72	0.34	59.30	5.42
M	3.23	0.62	40.29	10.40
VI. Action				
PC	1.15	0.36	42.96	5.62
C	4.88	0.18	60.19	3.95
A	4.86	0.20	61.59	3.38
M	4.67	0.30	63.40	4.06

Note:
1. CAD scales: PC - Precontemplation, C - Contemplation, A - Action, M - Maintenance
2. Raw scores of scale means range from 1 to 5
3. Standardized scale scores have M=50, SD=10

Table 2-3. Change Assessment Questionnaire for Drug Use (CAD) Scale Scores for Each Clusters: Sample 2 (n=324)

	Raw		Standardized	
Clusters / CAD Scales	**Mean**	**SD**	**Mean**	**SD**
I. Uninvolved				
PC	1.54	0.40	48.36	7.11
C	3.83	0.35	36.32	7.70
A	3.91	0.53	43.04	9.21
M	3.22	0.55	40.90	8.68
II. Precontemplation				
PC	2.23	0.49	61.65	8.64
C	4.21	0.33	44.66	7.23
A	4.06	0.27	47.66	5.35
M	3.83	0.49	50.20	6.42
III. Reluctant				
PC	1.96	0.57	55.80	9.04
C	4.57	0.37	52.44	8.13
A	3.18	0.52	31.92	8.12
M	3.91	0.74	52.09	8.71
IV. Contemplation				
PC	1.34	0.40	46.27	7.08
C	4.57	0.29	52.53	6.37
A	4.21	0.27	49.65	4.72
M	4.10	0.47	55.12	6.56
V. Preparation				
PC	1.30	0.34	44.81	5.83
C	4.78	0.24	57.18	5.26
A	4.80	0.25	59.32	4.09
M	2.99	0.60	39.46	6.95
VI. Action				
PC	1.12	0.20	42.34	3.86
C	4.87	0.21	59.07	4.60
A	4.91	0.12	61.03	2.50
M	4.52	0.41	60.08	5.50

Note:
1. CAD scales: PC - Precontemplation, C - Contemplation, A - Action, M - Maintenance
2. Raw scores of scale means range from 1 to 5
3. Standardized scale scores have M=50, SD=10

Table 2-4. Cluster Distribution of Samples A, B and the Combined Sample

Cluster	Sample 1 (N=310)		Sample 2 (N=323)		Combined (N=633)	
	n	%	n	%	n	%
Uninvolved	48	15.5	49	15.2	97	14.6
Precontemplation	60	19.4	73	22.6	133	20.0
Reluctant	32	10.3	26	8.0	58	8.7
Contemplation	78	25.2	76	23.5	154	23.1
Preparation	52	16.8	49	15.2	101	15.2
Action	40	12.9	50	15.5	90	15.5

Table 2-5. Cluster Differences of the Decisional Balance Inventory and Self Efficacy to Avoid Drugs: Combined Sample (N=633)

Scales / Clusters	Mean	SD	Follow-up Pattern (Tukey post-hoc comparison)	F (5, 627)	Effect Size η^2
I. Pros for Drug Use					
Uninvolved (U)	48.68	9.24	R > PR	5.39**	.04
Precontemplation (PC)	49.89	9.91	A > PR, C, U		
Reluctant (R)	52.89	9.66			
Contemplation (C)	49.56	9.73			
Preparation (PR)	47.23	9.91			
Action (A)	53.57	10.50			
II. Cons for Drug Use					
U	45.90	11.36	C > U, PC	13.11**	.09
PC	47.22	10.12	A > U, PC, R, C,		
R	50.36	10.23	PR		
C	51.89	8.20			
PR	49.59	10.49			
A	55.53	6.74			
III. Self Efficacy to Avoid Drugs					
U	52.02	9.23	PC > C	3.99*	.03
PC	49.67	10.14	PR > R, C		
R	47.89	9.02			
C	48.20	10.16			
PR	52.76	8.99			
A	49.64	11.10			

Scale scores are standardized with M=50, SD=10
* $p < .005$; ** $p < .0001$

Table 2-6. Highest Z-score Method: Stage Differences of the Decisional Balance Inventory and Self Efficacy to Avoid Drugs (N=638)

Scales / Stages of Change	Mean	SD	Follow-up Pattern (Tukey post-hoc comparison)	F (3, 634)	Effect Size η^2
I. Pros for Drug Use					
1. Precontemplation	49.21	9.84	M > A	3.87*	.02
2. Contemplation	50.92	9.77			
3. Action	48.00	10.17			
4. Maintenance	51.45	9.99			
II. Cons for Drug Use					
1. Precontemplation	45.77	10.28	A,C,M > PC	14.81**	.06
2. Contemplation	51.56	8.78			
3. Action	50.77	10.25			
4. Maintenance	52.01	9.47			
III. Self Efficacy to Avoid Drugs					
1. Precontemplation	51.96	9.78	A, PC > C, M	7.63*	.03
2. Contemplation	48.36	9.59			
3. Action	51.97	9.99			
4. Maintenance	48.11	10.3			

Scale scores are standardized with M=50, SD=10
* $p < .01$
** $p < .001$

Table 2-7 Profile Raw Score Method: Unstageable Profiles

Unstageable Profiles (PC, C, A, M)		n	%
- - - -		3	1.4
- + + + (C > A, M)		200	92.6
+ + - +		1	0.5
+ + + +		12	5.6
	Total	216	100.00

Note: Profiles scores were based on raw scale scores (PC, C, A, & M) with mean scores linearly transformed to a range of -2 to +2 and further recoded to "+" for positive mean scores and "-" for negative mean score and mean of 0.

Table 2-8 Profile Z-Score Method: Unstageable Profiles

Unstageable Profiles (PC, C, A, M)	n	%
- - - -	48	15.2
- - - +	22	7.0
- - + +	17	5.4
- + + + (C > A, M)	29	9.2
+ - - +	48	15.2
+ - + -	27	8.5
+ - + +	20	6.3
+ + - -	12	3.8
+ + - +	20	6.3
+ + + -	28	8.9
+ + + +	45	14.2
Total	316	100.00

Note: Profiles scores were based on z-score of each scale (PC, C, A, & M) which were recoded to "+" for positive mean scores and "-" for negative mean score and mean of 0.

Table 2-9 Stage Distribution Across Stage Allocation Methods

Cluster/Stages	Cluster Analysis		Highest Raw Score		Highest Z-score		Profile Raw Score		Profile Z-score	
	n	%	n	%	n	%	n	%	n	%
Uninvolved	97	14.6	--	--	--	--	--	--	--	--
Precontemplation	133	20.0	4	0.6	167	26.2	2	0.3	77	12.1
Reluctant	58	8.7	--	--	--	--	--	--	--	--
Contemplation	154	23.1	247	38.7	162	25.4	26	4.1	50	7.8
Preparation	101	15.2	--	--	--	--	26	4.1	32	5.0
Action	90	15.5	249	39.0	135	21.2	243	38.1	106	16.6
Maintenance	0	0.0	138	21.6	174	27.3	125	19.6	57	8.9
Unstageable	0	0.0	0	0.0	0	0.0	216	33.9	316	49.5
Missing data*	5	--	0		0		0		0	
Validation MANOVA (% variance accounted for)	15%		Not Conducted		10%		Not conducted		Not Conducted	
DFA correct classification rate Overall	24.0% (vs. 16.7% by chance)				34.6% (vs. 25% by chance)					
Uninvolved	35.1%				--					
PC	5.3%				46.1%					
Reluctant	13.8%				--					
C	14.3%				4.9%					
Prep	32.7%				--					
A	53.5%				44.4%					
M	--				43.7%					

Note: * missing data - 5 subjects were excluded in cluster analysis due to extreme scores (above or below 4 SD of the mean) of the CAD scales.

Table 2-10 Comparison of Stage Membership from Cluster Analysis vs. the Highest Z-score method

	Stages assessed by the Highest Z-score Method			
Clusters	PC	C	A	M
Uninvolved	55	14	17	11
	56.7%	14.4%	17.5%	11.3%
Precontemplation	81	23	2	27
	60.9%	17.3%	1.5%	20.3%
Reluctant	19	26	0	13
	32.8%	44.8%	0.0%	22.4%
Contemplation	2	68	11	73
	1.3%	44.2%	7.1%	47.4%
Preparation	6	18	77	0
	5.9%	17.8%	76.2%	0.0%
Action	0	12	28	50
	0.0%	13.3%	31.1%	55.6%

Note: Percentages indicate the proportion of subjects in each clusters who were reclassified by into one of the stages using the highest z-score method.

Table 2-11 CAD (Change Assessment for Drug Use) Score across Clusters

Clusters	n	Mean	SD	Minimum	Maximum
Uninvolved (U)	97	60.81	4.80	42.00	69.00
Precontemplation (PC)	133	64.08	3.38	55.00	71.00
Reluctant (R)	58	62.81	3.42	54.00	69.00
Contemplation (C)	154	70.38	2.33	65.00	77.00
Preparation (PR)	101	68.90	4.09	58.00	76.00
Action (A)	90	76.82	2.04	72.00	80.00

Note: 1 Tukey comparisons are significant at $p < .05$ with U < PC,R < PR < C < A.

2 Total score is based on the sum all item of CAD with PC items reverse-scored.

Table 2-12 Types of Living Environment before Admission across Clusters

Clusters /Types of Living Environment	Free-living	Drug Treatment Centers	Jail	Hospitals
Uninvolved	41.2%[a]	38.1%[c,d]	20.6%	0.0%
Precontemplation	37.6%	43.6%[c]	18.0%	0.8%
Reluctant	48.3%[a]	32.8%[c,d]	13.8%	5.2%
Contemplation	46.8%[a, b]	37.7%[c,d]	13.0%	2.6%
Preparation	25.7%[a]	56.4%[c]	15.8%	2.0%
Action	33.3%[b]	53.3%[d]	12.2%	1.1%
Total	38.9%	43.8%	15.6%	1.7%

Note. [a,b,c,d] denote significant results from 2x2 chi-square follow-up tests, $p < .05$.

[a] significant differences between Preparation and other clusters based on 2 (clusters) x 2 (free vs. controlled environment) chi-square tests.

[b] significant differences between Action and other clusters based on 2 (clusters) x 2 (free vs. controlled environment) chi-square tests.

[c] significant differences between Preparation and other clusters based on 2 (clusters) x 2 (drug tx vs. other) chi-square tests.

[d] significant differences between Action and other clusters based on 2 (clusters) x 2 (drug tx vs. other) chi-square tests.

Table 2-13. Cluster Differences relevant Variables: One-way ANOVA and Post-Hoc Tukey Comparison Results

Scales / Clusters	Mean	SD	Follow-up Pattern (Tukey post-hoc comparison)	F - value
I. Self Esteem (Rosenberg)				
Uninvolved (U)	27.46	4.64	PR > R,C, A	5.06*
Precontemplation (PC)	27.01	4.82		
Reluctant (R)	25.34	4.61		
Contemplation (C)	25.87	4.61		
Preparation (PR)	28.33	5.15		
Action (A)	25.98	5.08		
II. Depression (Beck Depression Inventory)				
U	16.69	8.09	PR < PC,R,C,A	5.62*
PC	17.79	9.40		
R	19.75	9.87		
C	18.13	8.90		
PR	13.33	8.61		
A	18.92	10.36		
III. ASI (Addiction Severity Index) Composite Score on Drug Use				
U	0.20	0.15	A, PR > U	4.03*
PC	0.26	0.15		
R	0.27	0.14		
C	0.24	0.15		
PR	0.27	0.15		
A	0.30	0.16		
IV. Perceived severity of Drug problems (ASI)				
U	2.18	1.79	A > U	4.02*
PC	2.72	1.56		
R	2.90	1.54		
C	2.74	1.69		
PR	2.79	1.64		
A	3.24	1.30		
V. Perceived Importance of Treatment for Drug Problems (ASI)				
U	2.51	1.87	A, PR, R > U	4.01*
PC	3.04	1.58	A > C	
R	3.30	1.37		
C	2.94	1.74		
PR	3.25	1.53		
A	3.57	1.23		

*p< .001

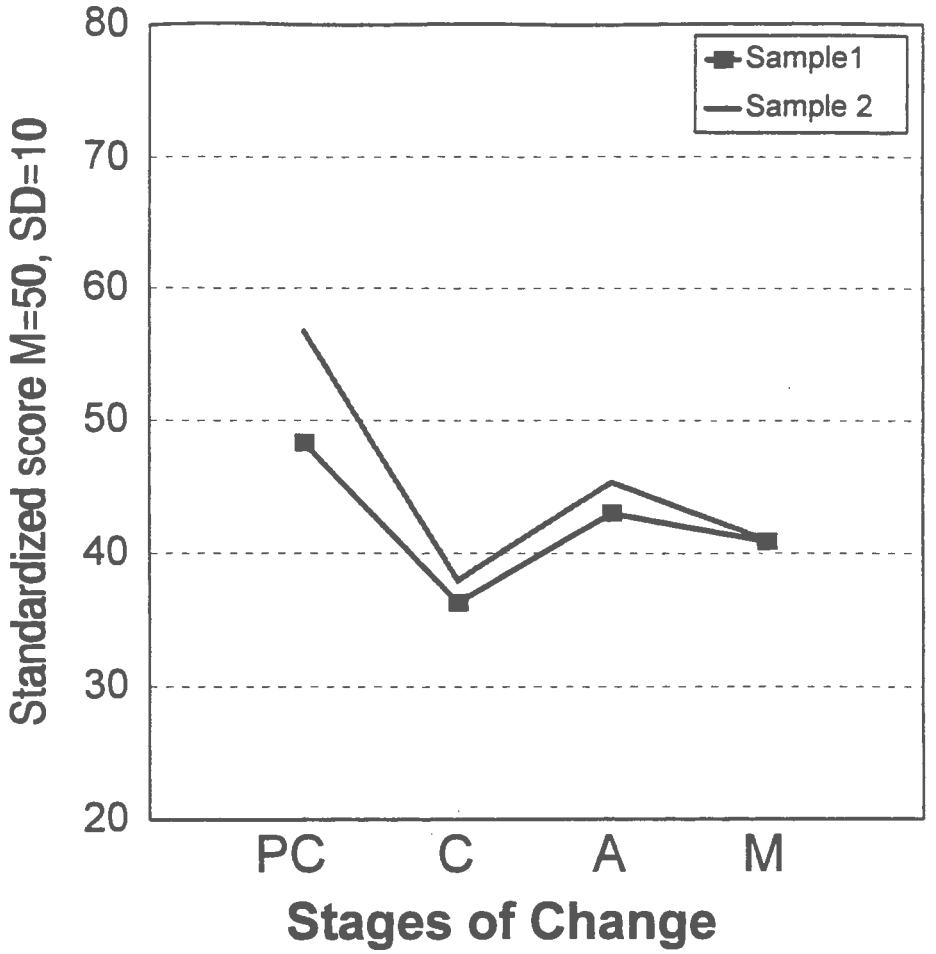

Figure 2-1. Uninvolved Cluster Profiles across Samples

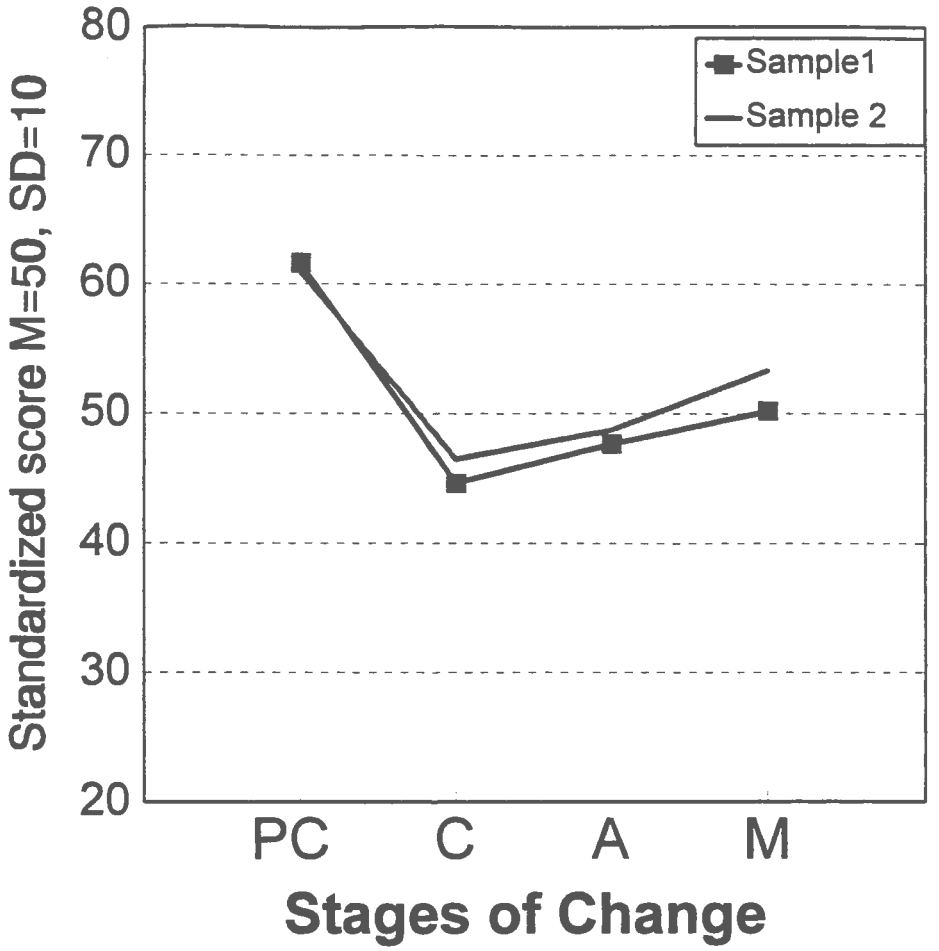

Figure 2-2. Precontemplation Cluster Profiles across Samples

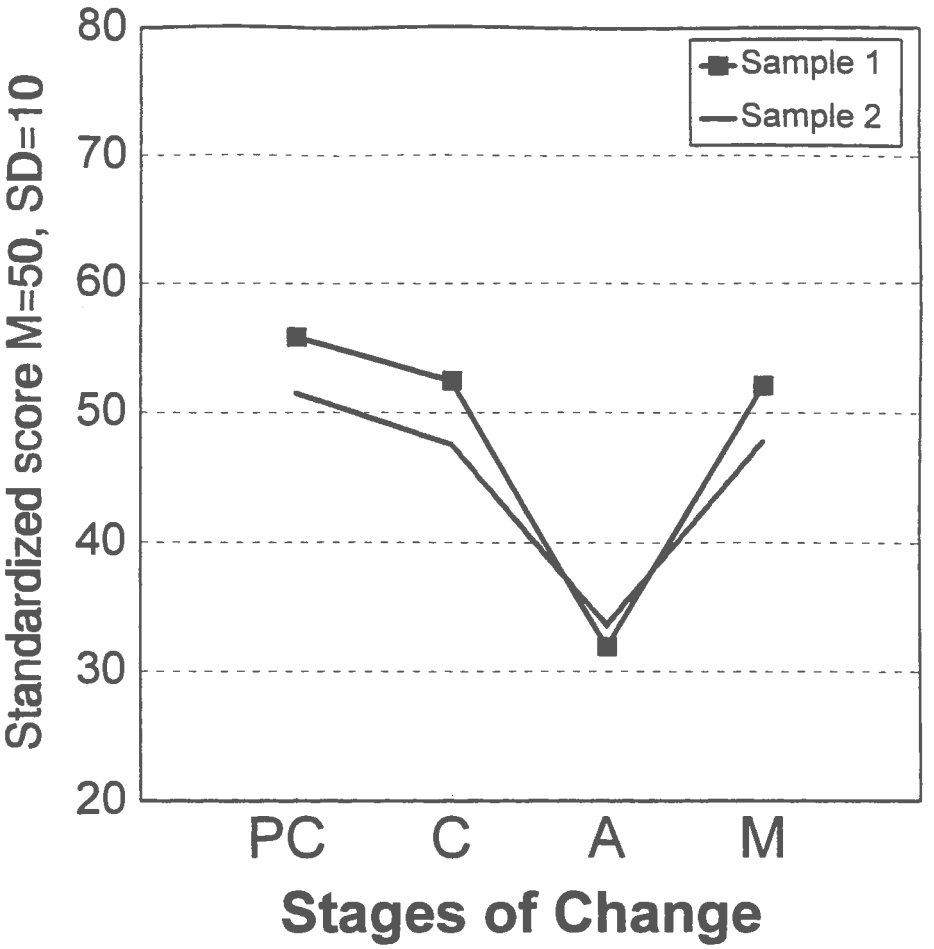

Figure 2-3. Reluctant Cluster Profiles across Samples

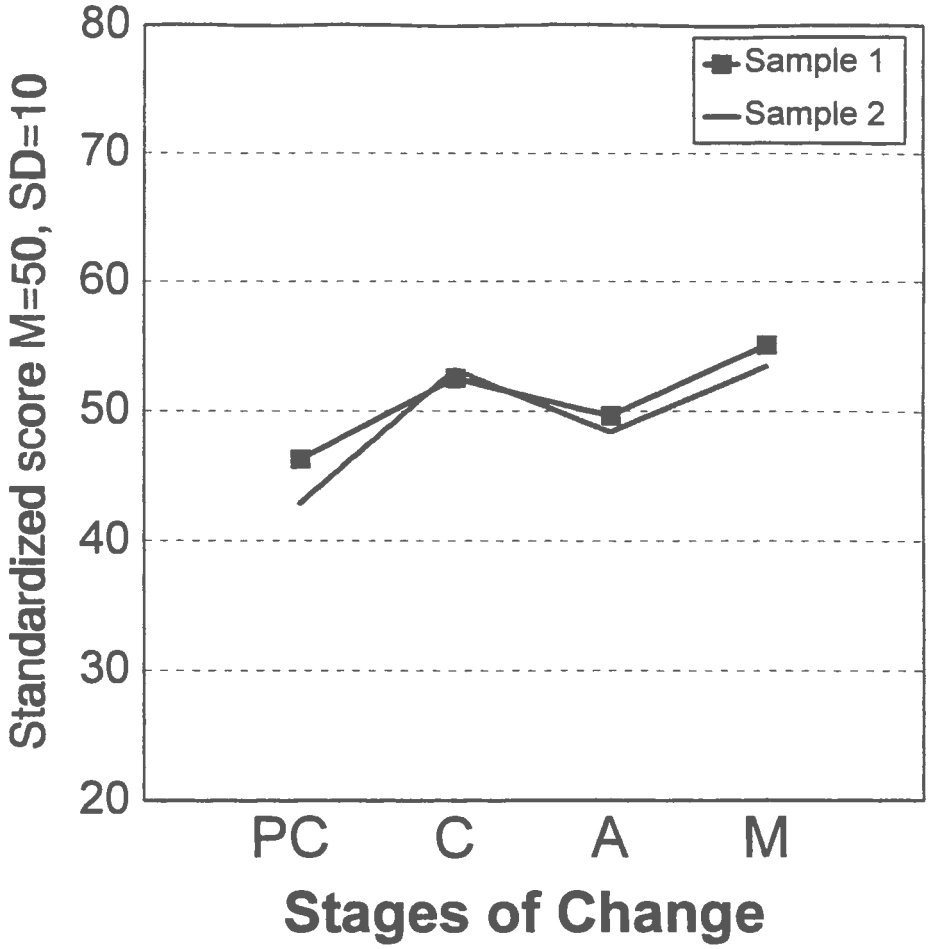

Figure 2-4. Contemplation Cluster Profiles across Samples

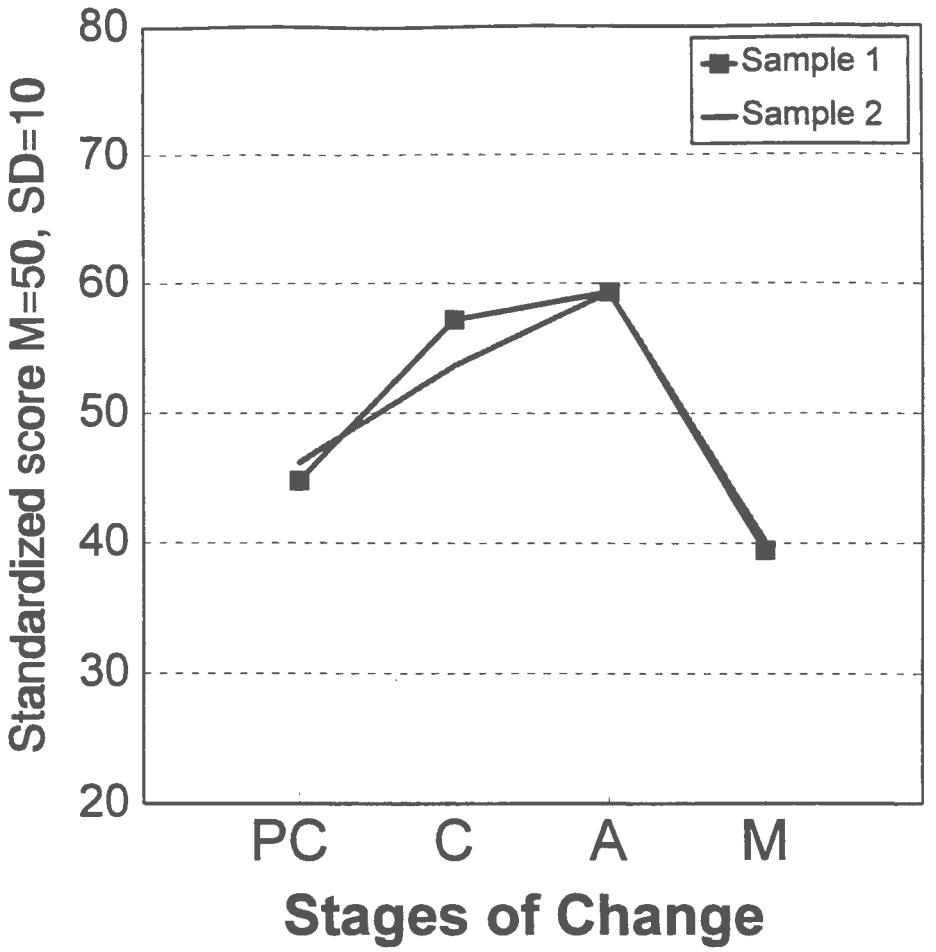

Figure 2-5. Preparation Cluster Profiles across Samples

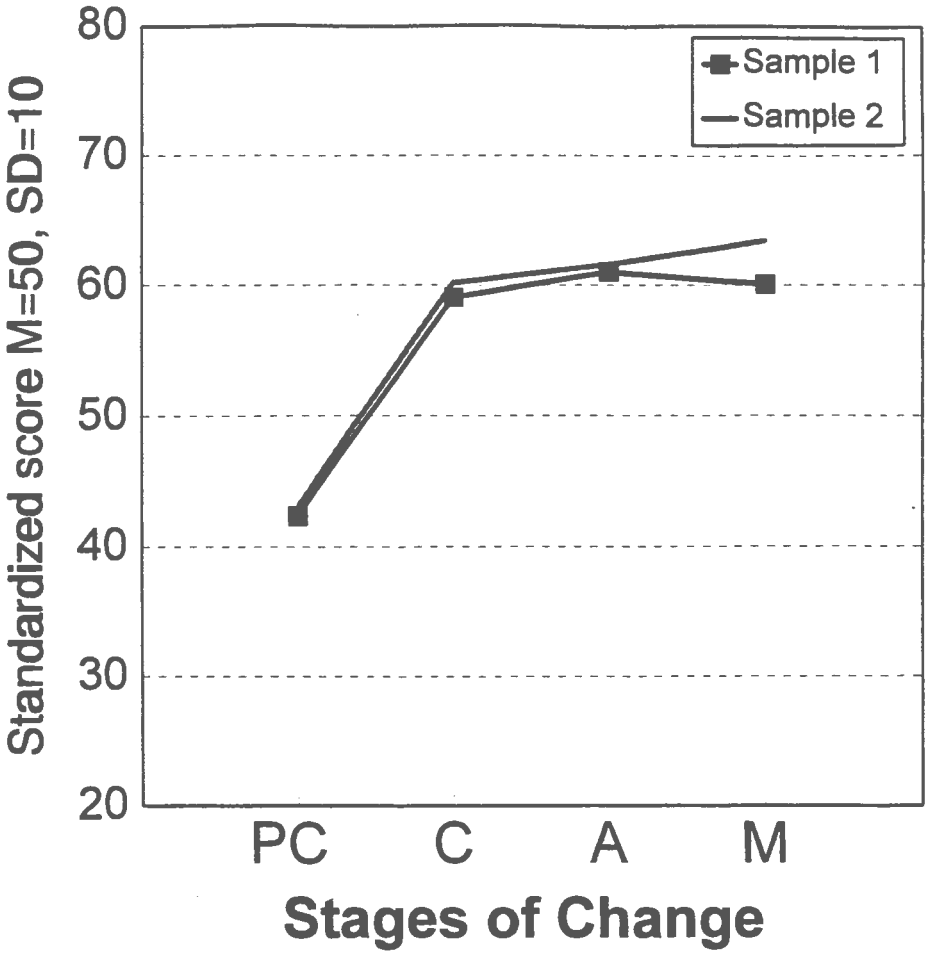

Figure 2-6. Action Cluster Profiles across Samples

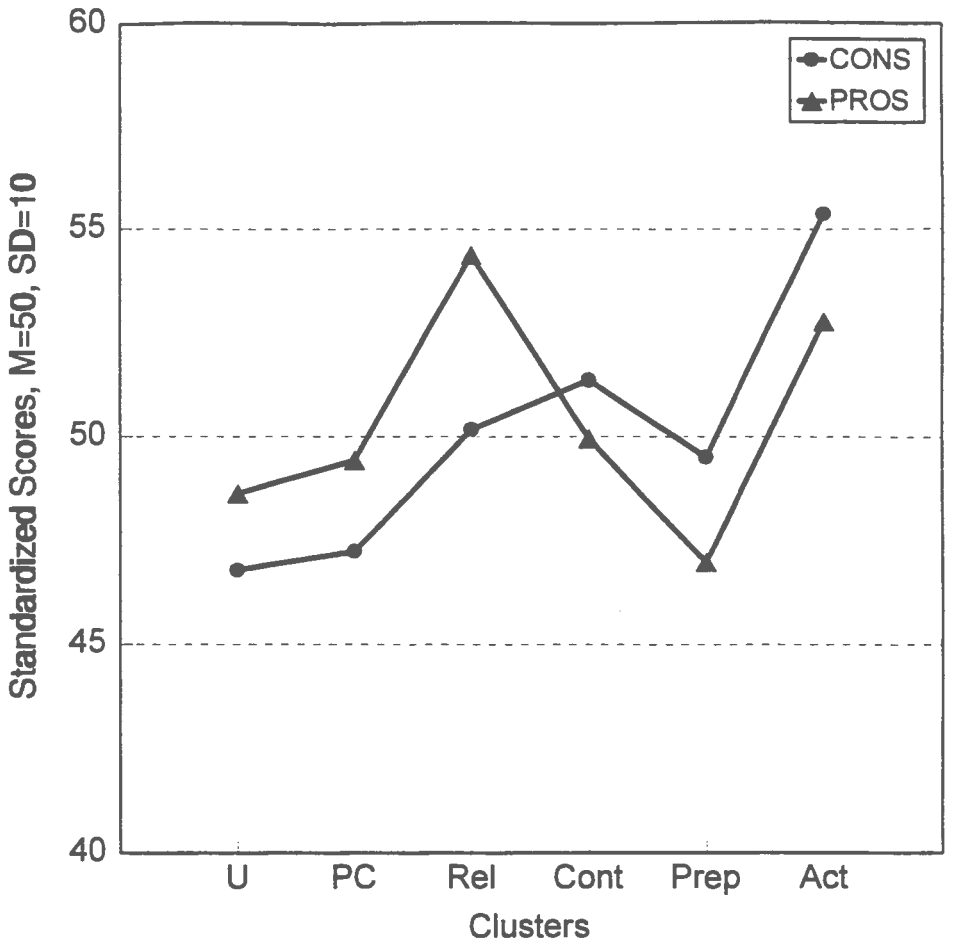

Figure 2-7. Decisional Balance for Drug Use across Clusters

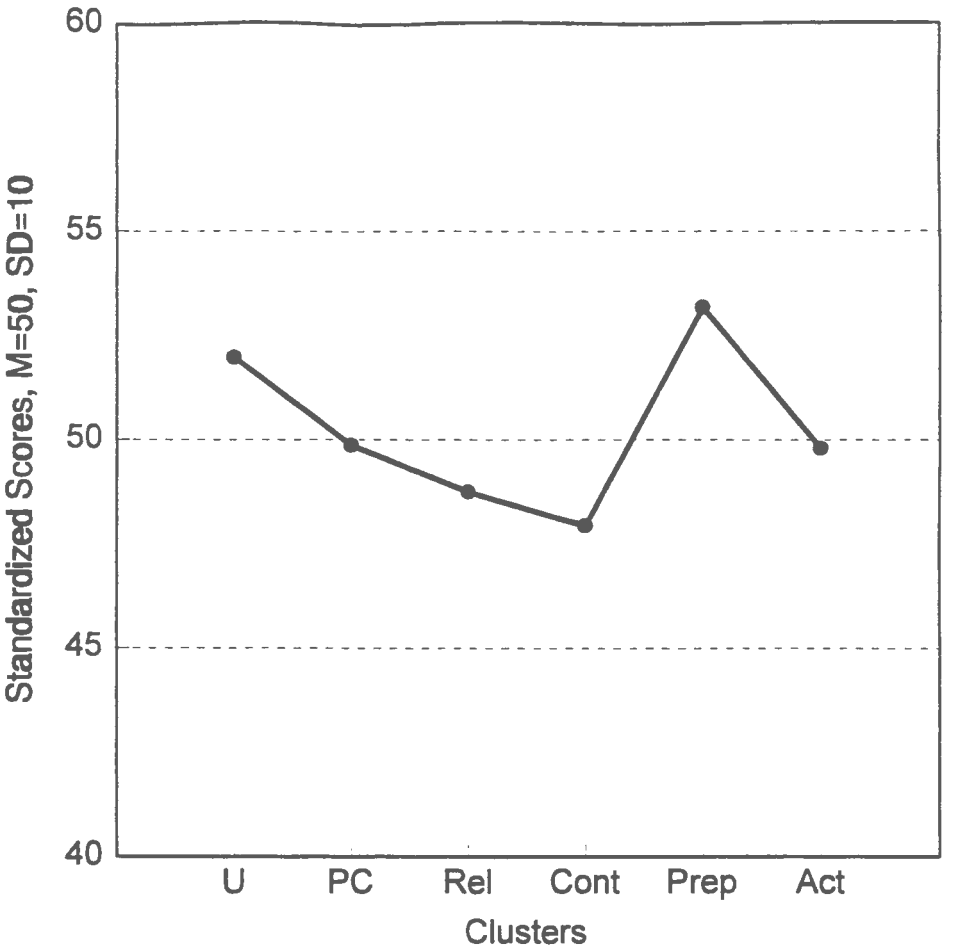

Figure 2-8. Self-Efficacy to Avoid Drug Use across Clusters

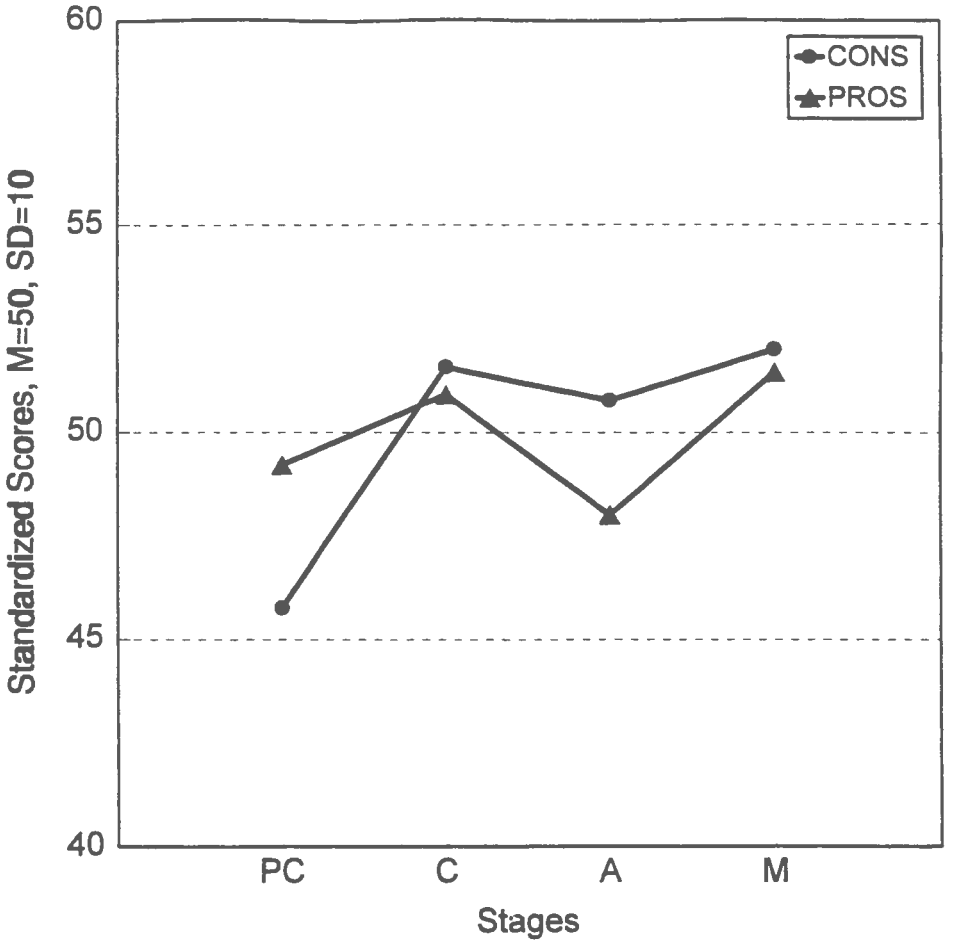

Figure 2-9. Decisional Balance for Drug Use across Stages based on Highest Z-score Method (N=638)

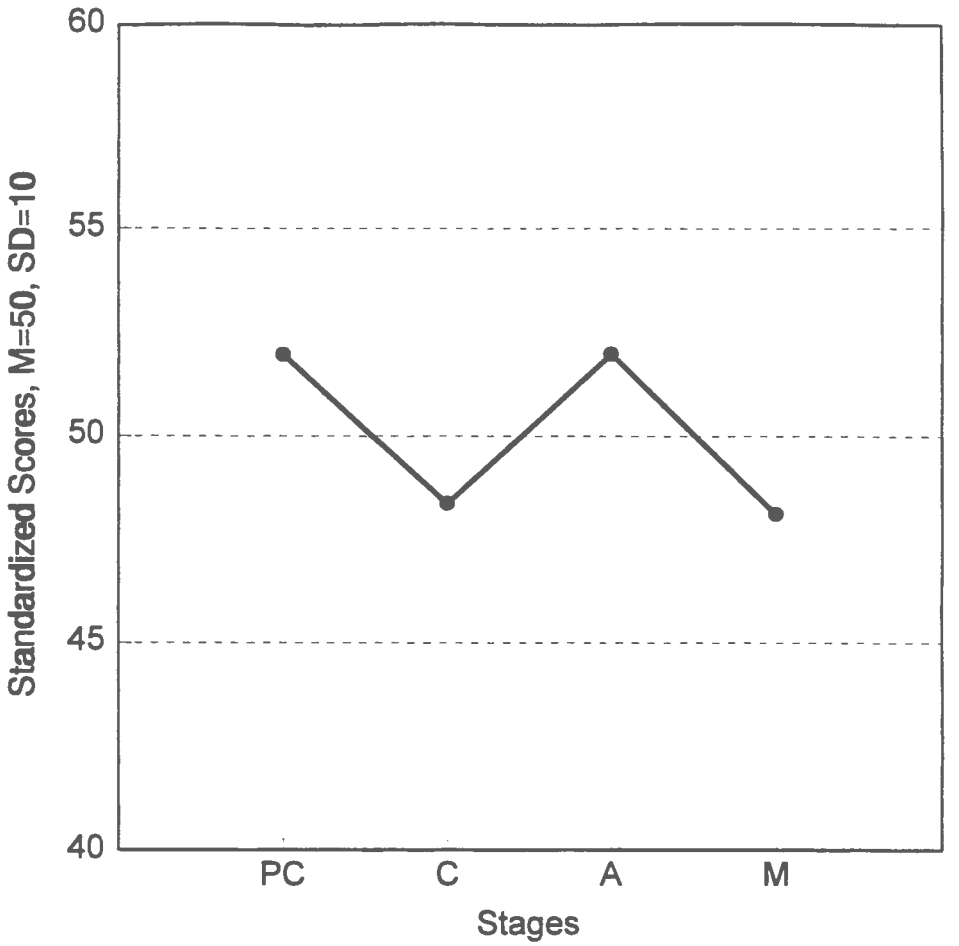

Figure 2-10. Self-Efficacy to Avoid Drug Use across Stages based on Highest Z-score Method (N=638)

STUDY 3 PREDICTORS OF DROPOUTS FROM SUBSTANCE ABUSE TREATMENT

Introduction

Despite the extensive evidence of the beneficial aspects of drug addiction treatment, questions on what contributes to successful treatment outcome continue to arise. Treatment retention has been shown to be the single most consistent predictor for treatment outcome (DeLeon, 1988; Hubbard, Marsden, Rachal, Harwood, Cavanaugh, & Ginzburg, 1989). Unfortunately, like treatment of other psychological problems, the majority of clients dropout of treatment before allowing treatment to take full effect. No comprehensive profile has yet emerged that predicts treatment retention (e.g., Condelli & De Leon, 1993; Hubbard et al., 1989). Furthermore, the true relationship between retention and outcome is not well understood. It is important to research who will be more likely to benefit from which modalities of treatment programs and for what length of treatment. Some systematic investigations that include individuals' attitudes, intention and behavior towards their drug use will be necessary to better understand the interaction between individual characteristics and treatment factors as well as their effects on retention and outcome in order to maximize treatment effectiveness. The Transtheoretical Model of Change (Prochaska & DiClemente, 1983, 1984, 1992) offers a promising systematic framework for this purpose.

Using the Transtheoretical Model of Change, 92% of the clients' continuation and termination status in psychotherapy was correctly predicted(Medeiros & Prochaska, 1991). Predictors were stages of change, processes of change, and decisional balance which are some of the core dimensions of behavior change as identified by the model (Prochaska & DiClemente, 1983, 1984, 1992). Most therapy continuers are found to be in the contemplation stage of

change (Medeiros & Prochaska, 1991). On the other hand, premature terminators or dropouts are more likely to be in the precontemplation stage and tend to be more oriented toward changing their environment than themselves. It is also one of the key features of most precontemplators that they try to use defenses such as avoidance in order to deny that they have a problem. Appropriate early terminators were found to highly endorse the action stage and were ready to take action when entering treatment. Therefore, they required fewer therapy sessions to achieve their therapeutic goals. Using the stages of change and change processes has also predicted both attendance and outcome in worksite weight control programs. Both accounted for over 30% of the attendance variance and over 40% of the variance for the amount of weight loss during treatment when these variables were assessed at mid-treatment; higher endorsement in action stage of change and in the use of action-oriented strategies was found to enhance attendance and outcome(Prochaska, Norcross, Fowler, Follick & Abrams, 1992).

Research in finding consistent and reliable predictors of treatment dropouts has been hampered by the lack of consensus on the operational definition of dropouts used among researchers. In reviewing 20 years of literature on dropping out of treatment across a variety of areas, Baekeland and Lundwall (1975) conceptualized dropout as a patient who fails or refuses to return to treatment and / or the patient who is expelled from treatment due to lack of cooperation or poor responses to treatment and so on. Wierzbicki and Pekarik (1993) conducted a meta-analysis of psychotherapy dropout based on 125 studies and summarized 3 categories of definition of dropouts used in the studies they reviewed. These categories include defining dropouts by clients failing to attend a scheduled session, therapist judgment, and duration-based measures using number of sessions or visits or length of stay in treatment. No single definition has been proven to be the most appropriate and each has inherent limitations. Wierzbicki and Pekarik (1993) have suggested that therapist judgment may be the best way to define dropouts

given that the concept of dropout comes from therapists' judgment: dropouts are those who terminate treatment inappropriately and would be "expected" to have a "less" successful outcome. That leads to a question of who and for how long clients can benefit from which treatment, which is the same question that research on treatment effectiveness has been investigating.

Research on treatment retention and outcome in the area of substance abuse has attempted to find the "minimal" exposure of treatment to produce successful outcome. For example, data from DARP (the Drug Abuse Reporting Program), the first large scale national study on treatment effectiveness for drug abusers, a minimum of 3 months was found to be necessary to produce positive changes, and the TOPS (Treatment Outcome Perspective Study) data suggested that treatment length of 6 months or more were necessary to produce reduction in drug use (Hubbard, Marsden, Rachal, Harwood, Cavanaugh, & Ginzburg, 1994). Condelli and Hubbard (1994) summarized the findings across various studies on treatment retention and outcome and reported the minimum length of stay in residential treatment programs (primarily therapeutic communities) for successful outcome ranged from 50 days to 1 year. The purpose of the present study was to determine if stages of change and other traditional subject characteristics variables at admission were predictors of treatment dropouts. Previous studies indicated that most clients dropout from treatment within the first 3 months, with the highest dropout rates in the first and the second month (Condelli, 1994). Dropouts in this study was defined as terminating treatment before 60 days.

Methodology

Participants

Participants were 385 clients (33% females) recruited for the study from a substance abuse residential facility. As participants were admitted to the facility, they were randomly

assigned to either the 3-month or the 6-month treatment. The treatment programs were based on a relapse prevention / health education model focusing on teaching coping skills for managing clients' addictive attitudes and behaviors in order to cope with high risk situations for relapse. Both "long" and "short" programs had essentially identical components except that the number of core group sessions of the 6-month program was twice as much as the 3-month program. The mean age of participants was 29.9 years (SD = 6.0). The ethnicity composition of the sample was 71.7% Caucasian, 20.0 African American, 7.3% Hispanic, 1.0% other. The mean education level was 12th grade. About 34% of participants had a full time job at the time of treatment, 45% were unemployed, and others worked part time, or had retired. The majority (91%) of the subjects had previous admissions to drug abuse treatment programs prior to the study. Main drugs of choice for the sample were heroin only (19%), cocaine only(24%), alcohol and drugs (28%), and polydrug (26%), with 47% IV drug users. Table 3-1 presents participant characteristics in greater details.

Procedures

Participants were recruited during intake interview at each facility that took place 14 days before or on the day of admission. Clients who were eligible to participate in the present study were all former drug abusers who completed detoxification or withdrawal and were admitted to the facility on a voluntary basis. Monetary incentives for participation were offered at $15 per interview. Admission interviews took place in 2 to 3 sessions that occurred during the first 8 days after admission. Data at exit were obtained from 7 days before anticipated day of discharge to 3 weeks after discharge with 77.7% (N=299) of the total subjects interviewed within this window.

Measures

Addiction Severity Index (ASI)

The Addiction Severity Index (ASI) (McLellan, Luborsky, Woody, & O'Brien, 1980; McLellan et al., 1985; McLellan, et al., 1992) is a semistructured interview that collects data from substance abusers in seven problems areas: medical, employment, legal, alcohol, drug use, family-social functioning, and psychological status. The primary goal of developing the ASI was to provide an instrument to assess treatment outcomes over a broad range of potential areas which could be affected by substance abuse treatment and can be applied across different treatment settings (McLellan, et al., 1992). The latest version, the fifth edition of the ASI, was used (McLellan, et al., 1992), with the addition of questions on personal and family psychiatric history. ASI covers general sociodemographics, as well as past and present information of each area. Composite scores can be computed from each area.

ASI is the most widely used clinical and research instrument in the area of substance abuse. The instrument has been validated across hundreds of studies during the past 14 years across different populations of substance abusers (e.g. Brown, Alterman, Rutherford, Cacciola & Zaballero, 1993; Hendriks, Kaplan, Limbeek, & Geerlings, 1989; Hodgins & Guebaly, 1992; McLellan, et al., 1992). Studies in the area of substance abuse have frequently used ASI scale scores for evaluation treatment efficacy and to validate newly developed scales for this area (e.g., Darke, Ward, Zador, & Swift, 1991; Kang, Kleinman, Woody, & Millman., 1991; Kosten, Rounsaville & Kleber, 1987).

Change Assessment for Drug Use (CAD)

This 16-item questionnaire refined in Study I was used to assess subjects' readiness to change their problem behavior. Subjects were asked to respond on a 5-point Likert Scale ranging from 1= strongly disagree to 5=strongly agree. Four items comprised each of the

four stages of change: Precontemplation (PC), Contemplation (C), Action (A) and Maintenance (M). This measure was administered at both admission and discharge interviews. The psychometric properties of the measure have been demonstrated in Study I with coefficient alphas ranging from .57 to .73 at baseline and .56 to .83 at exit. Stages of change at admission among participants were established in Study II. Six clusters were found with three clusters (Uninvolved, Reluctant and Precontemplation) characterizing having no interest in quitting drug use, and three other clusters namely Contemplation, Preparation and Action.

Decisional Balance Inventory

The 12-item scale modified from the Cocaine Decisional Balance Inventory (Rossi, Rosenbloom, Monti, Rohsenow, Prochaska, & Martin, 1993) was used. With some wording changes replacing "cocaine use" with "drug use", this 12-item version has been shown to be a valid measure for the decisional balance construct in a sample of drug addicts in treatment (Tsoh, 1993). Subjects were asked to rate each item on a 5-point Likert scale ranging from 1= not important to 5= extremely important. The items represent PROS and CONS for drug use with 12 items on each dimension. The psychometric properties of this measure was further examined in the present study. Items of the measure are shown in Appendix C.

Self-efficacy to avoid drugs

This self-efficacy scale contains 5 items assessing subjects' confidence in their ability to avoid drug use in high risk situations during the next 3 months. Subjects were asked to respond on a four point Likert Scale: 1=extremely confident to 4=not at all confident. Total score is the sum of all 5 items reverse scored, with the higher total score indicating higher confidence. The scale was developed by the data collected in this study at admission through various versions of the instrument with an item pool of 11 or 24 items. The factor structure was refined using the shorter version (n=370) and was confirmed using the long version (n=217). The internal

consistency as indicated by Cronbach's alpha, was .82 (Rubin, 1993). Items are shown in Appendix D.

Rosenberg Self-Esteem Scale

It contains 10 items assessing individuals' sense of self-worth, satisfaction with self, and belief in their own capabilities. Each item is scored on a four-point scale with 1=strongly agree and 4=strongly disagree. Test-retest reliability and validity in use with adolescent and young adult populations has been adequate (Rosenberg, 1965). Improved in self-esteem is a favorable outcome particularly for those in therapeutic communities.

Beck Depression Inventory

It is a 21-item self-administered questionnaire developed by Aaron Beck (1967). The number and severity of current depressive symptoms are assessed. Adequate reliability has been established in studies of psychotherapy.

Shipley-Institute of Living Scale

It is a self-administered test of cognitive functioning (Shipley, 1939). It contains a verbal and an abstract section. Scores are age-corrected and can be converted to an estimated WAIS-R IQ score with mean=100, SD=15. The estimated WAIS-R IQ score was used in the current study. Administration of the instrument was timed and subjects were allowed 15 minutes to complete each section.

Diagnostic Interview Schedule, Third Edition Revision (DIS-III-R)

An abbreviated version of the DIS-III-R which incorporates items for the DSM-III-R diagnostic criteria (American Psychiatric Association, 1987) was used. Only questions needed to ascertain some pre-selected DSM-III-R diagnoses were asked. Those diagnoses include panic disorder, social phobia, major depressive disorder, dysthymia, alcohol abuse and alcohol dependence, antisocial personality disorder, and pathological gambling. The decision to focus

on these diagnoses was based on considerations of prevalence of these disorders among drug abusers in treatment and evidence that particular disorders may be associated with treatment outcomes.

Social Desirability Scale

Jackson's Social Desirability Scale (Jackson, 1967) was used to assess response bias due to social desirability. This instrument consists of 20 items that are presented in a true-false format. It has been found to be a valid and reliable measure to determine if a response set tends toward the direction of social desirability.

Other variables

Data on other variables that have been associated with outcomes or retention from previous studies were also collected. Those variables included HIV status, sources of referrals, length of stay in treatment,

Variables of interest

Definition of Dropouts Dropout in this study was defined as by terminating treatment before 60 days into the program. Previous studies have suggested a range of a minimal of length of stay of 50 days to 6 months in residential treatment programs in order to produce longer-term (12-months or more) benefits. Based on the current data set, McCusker and colleagues have found that the two programs (3- vs. 6-month) did not differ in both attrition before 80 days as well as outcome defined as abstinence of drug use at 3-month posttreatment (McCusker, Bigelow, Zorn, Garfield & Love, 1994). In order to maximize the number of subjects in the analyses, the same definition of dropout (less than 60 days stayed in treatment) was used for both treatment programs. All subjects from both programs were used and enrollment in either the 3- or 6-month program were included as a variable in the analyses.

Predictor Variables. Predictors to be considered in the analyses of this study were variables collected during admission which include all participant characteristics as listed in Table 3-1. Other variables included psychiatric diagnoses (as stated above), depression level (Beck Depression Inventory), self-esteem (Rosenberg Self-Esteem scale), cognitive functioning (estimated WAIS-R IQ scores converted from Shipley), ASI composite scores of each area (medical, employment, legal, alcohol, drug use, family-social functioning, and psychological status), subjective ratings from the ASI measure which included perceived severity of and perceived importance of treatment for each problem areas. The Transtheoretical Model relevant variables included in the analyses were pros and cons of drug use, self efficacy to avoid drugs, and stages of change. To maximize sample size, the Uninvolved, Reluctant and Precontemplation clusters were grouped as a new combined Precontemplation cluster and was compared to other clusters, Contemplation, Preparation, and Action.

Analyses

Logistic regression (LR) was used to examine significant predictors of dropouts from treatment. LR was used to examine the predictability of the predictors on dropout status instead of discriminant function analysis (DFA) because LR has been demonstrated as a more powerful technique for binomial variables (e.g., Hosmer & Lemeshow, 1989; Norusis, 1990). In the current study, the dependent variable was dichotomous, dropouts vs. continuers; furthermore, many potential predicting variables in this study were categorical in nature. The goal of the analyses was to seek significant predictors that would yield the most parsimonious model to predict dropouts within the constraints of the current data. Owing to the large number of independent variables that could be included in the model, the following variable selection procedures recommended by Hosmer and Lemeshow (1989) were carried out.

1). Variables were initially subjected to a series of bivariate analyses such as ANOVA or Chi-squares procedures. Only variables that differentiated between dropouts and continuers at a p-value of .20 (Hosmer & Lemeshow, 1989; Lemeshow, 1993) were included in the Logistic Regression Analysis followed.

2). The weakness of unnivariate analyses is that they do not examine the combination effect of multiple variables. Therefore, the subset of variables selected from the bivariate analyses in Step 1 was examined by stepwise LR. A stepwise procedure was recommended as an effective procedure to select the best subset of predictors from a large number of variables (Hosmer & Lemeshow, 1989). The stepwise procedure has been criticized for producing models that are not theoretically plausible containing irrelevant (or noise) variables (see Hosmer & Lemeshow, 1989). However, when variables subjected to LR analysis are considered to be theoretically and scientifically relevant, a step-wise procedure has the advantage of statistically selecting variable in a sequential fashion and allowing examination of a collection of variables which has not been otherwise studied.

In a forward stepwise procedure, it begins with a model that contains only a constant (or an intercept as in multiple regression). At each step, selection of a variable is based on the statistical importance of the variable determined by the likelihood ratio chi-square test. The log-likelihood ratio (LL) assesses the overall fit of the model in successfully classifying the observed data based on the parameters in the model, with a perfect fit equals to 1. The likelihood ratio is usually smaller than 1 and a log function of that ration is used. Therefore a log likelihood ratio of 0 is expected for a perfect fit. Variable selection is based on the change in Log-likelihood ratio of the model with and without the variable under consideration. A variable is selected when the largest improvement in LL (overall model-fit) is produced. Similarly, the removal of a variable in this case is based on the change in the ratios with and without the variables. This

process of variable selection repeats until no significant change is obtained upon inclusion of additional variables or exclusion of the model parameters.

3). Variables that remained in the model after the stepwise LR analysis with significant regression coefficients (p-value of Wald statistics <.05) were selected. All possible first order interactions between each pair of the selected variables were examined. A series of standard LR was performed with each interaction term entered in the main effects model. An interaction term with Wald statistics of $p<.01$ was selected. The interaction terms selected were then entered together in the main effects model for further examination. The selection procedure yielded a final model that consisted of significant predictors and their interactions.

4). After selection of variable was completed, odds ratio (OR) and its 95% confidence interval (95% CI) of each predictor were calculated and used to interpret the magnitude of predictability. For categorical variables, the odds ratio is expressed in terms of the change in the estimated probability of a targeted outcome (e.g., dropout) to occur when comparing variable in one category to another. For example, in this study, odds ratio of stages of change for predicting dropout could be expressed in how much more likely would someone from the PC cluster to dropout before 60 days as compared to individuals in the A cluster. In case of continuous predictor, odds ratio is the change probability of the targeted outcome to occur in correspondence to one unit change in the predictor.

In addition, the relevance of the current definition of dropouts in this study was examined. MANOVA and ANOVA were conducted to examine the differences between dropouts and continuers with respect to the measures obtained during exit interview, which included the CAD (Stages of Change), Decisional Balance Inventory of Drug Use, Self-efficacy to Avoid Drug Use, self-esteem and depression level (BDI).

Results

Predictors of Dropouts

Of the 385 participants, 30.4% (n=117) dropped out before 60 days in treatment. No significant difference was found in dropout rates between the 3-month (30.3%) and 6-month (30.5%) programs. After a series of bivariate analyses of baseline variables, variables with p-value <.20 were subjected to logistic regression analysis. They included stages of change, self-efficacy to avoid drug use, education, ASI medical subscale, cognitive functioning, legal involvement, perceived HIV status, race, psychopathology include depression, antisocial personality, pathological gambling, panic disorder, IV users, and previous treatment history. The list of variables subjected to stepwise logistic regression are presented in Table 3-2 with descriptive statistics across the two groups of dropouts vs. continuers. The stepwise logistic regression model examining all potential predictors for dropouts yielded four significant predictors: education, stages of change, number of previous treatments and perceived importance of treatment for social problems. More specifically, less education, being in PC as compared to C and to PR, having more previous treatment, and perceiving treatment for social problems as more important were associated with dropout. The regression coefficient for stages of change when comparing Action to PC in predicting dropout status was not significant in the model ($p > .20$). No interactions between stages of change and other variables, or any variable pairs were found significant. Table 3-3 presents the final model parameters, odds ratios and their 95% confidence intervals of each significant predictor when other predictors are controlled.

Dropouts vs. Continuers

MANOVA conducted on CAD subscales (PC, C, A, M), pros and cons, self-efficacy to compare dropouts and continuers indicated a significant main effect of dropout status, Wilks $\lambda = .85$, $F(9,242) = 4.63$, $p<.001$. Table 3-4 presents the follow-up univariate ANOVA results.

The two groups were significantly different on depression (BDI score), self-esteem, self-efficacy to avoid drugs, and 3 CAD subscales including PC, C and A. As compared to individuals who stayed in treatment beyond 60 days, dropouts tended to report more depressive symptoms, lower self-esteem, lower self-efficacy, higher score on PC, lower scores on C and A scales at discharge. However, it should be noted that there was a significant decrease in sample size when the discharge data were analyzed. Only 50% (58 out of 117) of the dropouts as compared to 89% of the continuers (238 out of 268) who had discharge data. The average length of stay of subjects who had discharge data within the pre-selected window (7 days before discharge to 3 weeks post discharge) was 91.9 days, which was significantly longer than those who did not have exit data within the window (65.4 days), $F(1,383) = 17.74$, $p<.001$.

Discussion

Current findings indicated that a significant portion (>30%) of substance abuse patients in treatment dropped out within the first 60 days and well before full treatment can occur. Dropout rates found in this study were comparable to other studies on residential treatment settings (e.g., Hubbard et al., 1989). Interestingly , the two programs (3-month vs. 6-month) were similar in their attrition rates before 60 days, approximately about one third dropped out before 60 days. The hypothesis that individuals in PC were more likely to dropout from treatment prematurely was supported by the current findings. Stages of change was among one of the strongest predictors of early dropouts. When other parameters of the regression model were controlled, PC individuals were 2 to 3 times more likely to drop out from treatment before 60 days as compared to Contemplation and Preparation respectively. However, there was no statistical differences between individuals in PC and A regarding dropout rate. It was unclear from the current findings, whether the little difference observed was because "less time" was required by individuals who were more "advanced" in readiness for change. For example, in

Medeiros and Prochaska's study (1991) on termination and continuation status of psychotherapy outpatients, individuals endorsed highly in Action were more likely to terminate treatment early but appropriately, and those individuals needed less time in treatment as compared to others who might need a relatively longer period of time. Furthermore, findings indicated a sample scenario of a "mismatch" between client and the philosophy of treatment programs. In the current sample, a relatively large portion (over 40%) of clients were not ready to quit drugs, even though they presented themselves "voluntarily" to treatment. A mismatch occurred when individuals were not ready to quit using drugs but were presented to an action-oriented program in which they were introduced to strategies of how to avoid drug use. The likely consequence of such a mismatch, as supported by the current findings, was premature dropout from treatment. As indicated from previous studies, the minimum stay of 50 days to 3 months or longer was necessary to produce treatment benefits (Condelli & Hubbard, 1994; Hubbard et al., 1989). These dropouts are costly, not only because of high relapse rates associated with early dropouts and related costs (e.g., Hubbard et al., 1989), but also the impact on increasing waiting period for drug addicts who are seeking treatment given the limited resources. Again, these findings have underscored the importance of recognizing clients' readiness for change, rather than making assumptions that all patients presenting to treatment are ready to change.

Other significant predictors have been demonstrated in previous studies (e.g., Condelli & Hubbard, 1994). More educated clients tend to continue treatment, as opposed to less educated ones. These findings also underscored the importance of special care for less educated disadvantaged clients in treatment who tended to be more likely to drop out from treatment. Similar findings also observed in relapse prevention focused programs in this study where more educated clients might be more capable of benefiting from this form of treatment which tends to require a higher level of cognitive competency.

Current findings also suggested that individuals who have more previous treatment experience tended to dropout treatment early. While a number of previous studies demonstrated a similar finding (e.g., Beckman & Bardsley, 1986; Condelli & Hubbard, 1994), it is a confounding variable that covaries with age and duration of drug use (Stark, 1992). Although previous studies suggested that treatment history variable might be related to readiness of change, in which individuals who have been treated more frequently previously tend to be more ready to quite using drugs. Current results indicated no significant interactions between readiness and any of the predictors. Perhaps, the increase in the number of previous treatment experience might likely reflect previous treatment failure due to premature dropouts. Therefore, individuals who dropped out from treatment previously might be likely to drop out from the current treatment.

Lastly, perceived importance of treatment for social problems as a significant predictor was an interesting finding. Previous studies suggested that social support has a positive relationship with treatment retention (Sidall & Conway, 1988). Current findings might imply some social support relevant dimensions when individuals indicated desire for assistance on social problems which might be related to perceived low level of social support. When these individuals did not feel that treatment has met their needs of coping with interpersonal issues, with a lack of social support, they may tend to drop out of treatment earlier. Perhaps, by increasing the focus on social relationships, how to obtain better support, and the benefits of seeking treatment for their social environment, might improve their adherence and thereby reducing likelihood of dropout.

Results in comparing dropouts and continuers provided preliminary support for the relevance in studying dropout before 60 days into treatment in this residential setting. Dropouts presented more negative prognostic indicators for future outcome. These individuals tended to

be more depressed, less self-confident in avoiding drug use, less ready to change as denoted by higher score in PC, and lower scores on both C and A, and have lower self-esteem. Surprisingly, the two groups did not differ with respect to their value on the pros and cons of drug use. Although dropouts displayed a tendency of higher pros and lower cons of drug use, the difference was small and non-significant. However, the current comparisons between dropouts and continuers were based on the discharge data where dropouts were less likely to have these data for comparisons (only 50% of dropouts have discharge data vs. 88% of continuers). Therefore, interpretation with the current results should be cautious. To what extent these preliminary differences between dropouts and continues were predicative of future outcome requires further examination. The following study investigated further these measures in predicting a short-term 3-month post treatment outcome.

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Table 3-1. Participant Characteristics

Demographic Information		
Treatment Setting	**N**	**%**
Residential (3-month)	188	48.8
Residential (6-month)	197	51.2
Total	385	
Stages of Change at Admission		
Uninvolved	51	13.2
Precontemplation	83	21.6
Reluctant	37	9.6
Contemplation	98	25.4
Preparation	60	15.6
Action	56	14.5
missing	0	
Referral		
Legal	45	11.7
Self	340	88.3
missing	0	
Gender		
Male	258	67.0
Female	127	33.0
Age		
under 21	14	3.6
21-25	89	23.2
26-30	112	29.2
31-35	104	27.1
36-40	45	11.7
41 or older	20	5.2
missing	1	
Race		
Caucasian	274	71.7
African American	76	20.0
Hispanic	28	7.3
Other	4	1.0
missing	3	
Marital Status		
Single	261	69.8
Married / Living together	26	7.0
Separated	28	7.5
Divorced	57	15.2
Widowed	2	0.5
Missing	11	

Table 3-1. Participant Characteristics (cont'd)

Education	n	%
< 12	120	31.7
High school	178	47.0
Some College	62	16.2
College	14	3.6
Post graduate	5	1.5
missing	6	
Yearly Income		
under $5,000	161	42.7
$5,000 - 9,999	46	12.2
$10,000 - 19,999	50	13.3
$20,000 - 29,999	30	8.0
$30,000 - 39,999	32	8.5
$40,000 or over	58	15.4
missing	8	
Employment Status		
Unemployed	193	50.9
Part time	48	12.7
Full time / self employed	130	34.3
Student / Retired	8	2.1
missing	6	
Legal Status		
Waiting charges	130	47.3
Probation / Parole	79	20.8
not applicable	170	44.9
missing	6	
HIV positive		
Yes	15	4.8
No/.Not sure	295	95.2
missing	75	
Previous Drug Abuse Treatment		
0	34	9.2
1	56	15.1
2-4	144	38.8
5 or more	137	36.9
missing	14	
Drug of Choice		
Alcohol only	14	3.6
Alcohol and drug	107	27.8
Cocaine only	91	23.6
Heroin only	73	19.0
Polydrug	98	25.5
Other	2	0.5

Table 3-1. Participant Characteristics (cont'd)

IV Drug Users ***(used IV during 3 months prior to admission)***		
Yes	203	52.7
No	182	47.3
Age First Used Drugs		
Under 13	97	25.3
13-17	246	64.1
18-20	21	5.4
21-30	20	5.2
missing	1	
Age First Used IV		
Under 13	9	3.9
13-17	71	30.5
18-20	50	21.5
21-30	99	42.5
31 or older	4	1.6
Total	152	
Types of Living Situation before Admission		
Free-living	153	39.7
Drug Treatment Centers	202	52.5
Jail	27	7.0
Hospital	3	0.8

Table 3-2. Variables included in Logistic Regression Analysis for Dropout Status: Univariate Results Comparing Treatment Dropouts and Continuers

Demographic /Background Variables	Dropouts	Continuers (stayed in treatment beyond 60 days)	p-value
Race (non-white)	23.1%	31.3%	.10
Education Mean (SD)	11.05 (2.03)	12.06 (2.06)	.01
Number of previous treatment	5.82 (6.21)	4.43 (4.85)	.02
IV users	52.1%	45.1%	.20
HIV+	8.0%	3.6%	.11
ASI measures:			
Composite score - Medical	0.16 (0.31)	0.11 (0.24)	.09
Perceived severity of social problems (0-4)	1.56 (1.68)	1.26 (1.66)	.11
Perceived importance of treatment for social problems (0-4)	1.51 (1.76)	1.20 (1.69)	.11
Psychiatric Diagnosis/ Functioning			
Antisocial Personality disorder	69.1%	53.2%	.01
Pathological gambling	22.2%	14.2%	.05
Panic disorder	4.3%	9.7%	.07
Depression level (BDI)	19.29 (9.99)	16.98 (9.47)	.03
Stages of Change (Clusters)			.02
Precontemplation	55.6%	39.5%	
Contemplation	19.7%	28.0%	
Preparation	9.4%	18.3%	
Action	15.3%	14.2%	
Self Efficacy	2.93 (0.68)	2.86 (0.69)	.19

Table 3-3 Significant Predictors of Dropouts: Wald Statistics, Odds ratios (OR) and 95% Confidence Intervals

Predictors	Wald	p - value	OR	95% CI
Stages of Change	10.65	.014		
PC compared to C	6.28	.012	2.20	1.19 - 4.09
PC compared to PR	7.02	.008	2.86	1.31 - 6.22
PC compared to A	1.15	.283	1.09	0.50 - 2.88
Education (years)	14.42	.001	0.79	0.67 - 0.91
Number of previous treatments	7.36	.007	1.06	1.02 - 1.10
Perceived importance of treatment for social problems	3.93	.047	1.15	1.01 - 1.29

Table 3-4. Difference between Dropouts and Continuers on Measures Obtained at Discharge

Measures at Exit	Dropouts (n=58)	Continuers -stayed in treatment beyond 60 days (n=238)	F-value
Change Assessment Scale (Mean ranged from 1-5)	Mean (SD)	Mean (SD)	
PC	1.98 (0.72)	1.57 (0.76)	11.78**
C	4.03 (0.91)	4.28 (0.68)	4.86*
A	3.86 (0.90)	4.32 (0.73)	14.43**
M	3.44 (0.91)	3.49 (0.73)	NS
Decisional Inventory (Scale mean ranged from 1-5)			
PROS	2.37 (0.99)	2.29 (0.97)	NS
CONS	4.09 (0.92)	4.22 (0.84)	NS
Self-efface (Scale mean ranged from 1-4)	3.15 (0.58)	3.46 (0.39)	22.68***
	Sum (SD)	Sum (SD)	
Self-esteem (Rosenberg)	29.36 (4.48)	31.86 (4.48)	14.34**
Depression level (BDI)	14.29 (9.16)	8.91 (8.44)	15.64***

STUDY 4 PREDICTORS FOR TREATMENT OUTCOME

Introduction

The fast growing substance abuse treatment industry over a short history of 30 years reflects the increasing burdens of substance abuse on society. In 1988, it was estimated that the costs of alcohol abuse and the abuse of other drugs in the US. were $86 billion and $58 billion respectively (Stimmel, 1991). As of 1990, the estimated costs have gone up to $99 billion and $67 billion for alcohol and other drug abuse respectively (Institute for Health Policy, 1993). The core costs of substance abuse fall in medical expenses, illness, premature deaths, and criminality. Given the role of IV drug users in the spreading of AIDS and the high association of drug use and crime, drug addiction is not only a health concern at an individual level but also a broad social problem. The threat imposed by drug users on both public health and safety has encouraged civil commitment practices directed toward drug users. Drug abuse treatment programs nowadays serve purposes of both protecting societies and promoting individual well-being (Brown, 1988; Platt, Buhringer, Kaplan, Brown & Taube, 1988).

There has been extensive evidence showing that most drug addiction treatment, regardless of modality, benefit their clients (e.g., Institute of Medicine, 1990). In summing the effectiveness of substance abuse treatment, researchers pointed out (Mejta, Naylor & Maslar, 1994) that although treatment seemed to work and yield positive outcome in general, there has been between 10% to 20% completed treatment and about 70% of drug addicts relapse within the first year post treatment. The questions on what contributes to successful treatment, and successful outcome continue to arise.

Research on predictors for treatment outcome has yielded divergent results. Some studies have found that positive outcomes appear to relate to subjects who are older, male,

white, being employed full time, being first time in treatment, and having lower ratings on severity of drug use. However some studies suggested little relationships between most sociodemographic variables and outcome (e.g., Gorelick, 1992; Hubbard, Marsden, Rachal, Harwood, Cavanaugh, & Ginzburg, 1989; Kosten, Rounsaville, & Kleber, 1987). Regarding sources of referrals (legal versus self), the literature has not shown consistent support for an association between legal referral and outcome success (Hubbard, Collins, Rachal, & Cavanaugh, 1988). Research has begun to examine relationships between HIV status and treatment outcome, and no substantial relationship with outcome has been reported. However, HIV positive individuals appear to be more motivated (McCusker, Bigelow, Frost, Hindin, Vickers-Lahti, & Zorn, 1994) and tend to more likely complete treatment (Weddington, Haertzen, Hess & Brown, 1991). Increased self-efficacy during treatment has been found to be higher among abstainers than relapsers at follow-up (Burling, Reily, Moltzen, & Ziff, 1989). However no relationship was found between self-efficacy ratings and outcome status in another study (Mayer & Koeningsmark, 1991). Other subject characteristics, such as psychiatric status, cognitive functioning, and their relationships with outcome have also been studied. Relatively poor treatment outcomes appear to be related to impaired cognitive functioning, major depressive disorder, and antisocial personality disorder (e.g., Fals-Stewart & Schafer, 1992; Kay, 1985).

One of the barriers to converging the findings from a huge literature in the area of substance abuse treatment is the lack of consensus in defining treatment outcome. Froyd and Lambert reviewed outcome assessment used in 348 studies published in 20 major journals between 1983 to 1988. They found that over 1400 distinct measures have been applied in those studies (see Lambert, 1990). Although no measures of treatment outcome has been used as a "gold standard" in the area of substance abuse, the common goal underlying most treatment has

been abstinence of drug use or at least reduction of drug use (e.g. Hubbard et al., 1989; Lambert, 1990). Therefore, one type of the most commonly used indicators for treatment outcome has focused primarily on drug usage. Wells and colleagues (1988) summarizes five major categories of measures in outcome studies of substance abuse including consumption measures, categorical classification, weighted indices of seriousness, composite scores of problem severity, and patterns of use. Other researchers have conceptualized outcome as multidimensional, where drug use is only one of the dimensions and recovery from drug addiction should involve improvement in other areas such as psychosocial function, physical well-being, criminality, self-esteem and so on (e.g., Condelli & Hubbard, 1994; Kosten et al., 1987). Owing to the positive relationship found between treatment retention and outcome, some studies have also used treatment retention as an indicator of treatment outcome.

Indeed, the length of stay in treatment has shown to be the single most consistent predictor of outcome across all treatment modalities (Charuvastra, Dalali, Cassuci, & Ling, 1992; DeLeon, 1988; De Leon & Jainchill, 1986; French, Zarkin, Hubbard, Rachal, 1993; Hubbard et al., 1989). Research comparing treatment outcome of dropouts versus completors has been able to consistently yield more favorable outcome for treatment completors (e.g., Baekeland & Lundwell, 1975, Hubbard et. al., 1989, Stark, 1992). Unfortunately, like treatment of other psychological problems, dropout is prevalent in all drug abuse treatment programs (De Leon & Jainchill, 1986). A large portion of clients drops out of treatment prematurely well before full treatment can take effect. Thus far, no consistent profile of characteristics have been identified that predicts treatment outcome. Therefore, even though length of stay in treatment appears to be a promising and reliable predictor of outcome, this finding has not contributed very much to the understanding of the process of successful treatment .

A recent trend in research on predictors of outcome has moved from traditional

fixed/static background or demographic parameters to dynamic/changeable variables. Changeable variables can be directly or indirectly intervened upon and thereby it is believed to be more helpful in understanding the process of recovery. Examples of dynamic variables that have been studied include motivation, self-esteem, psychological symptoms and so on. One major problem, however, is the lack of systematic framework and standardized measure in assessing changeable variables. The Transtheoretical Model of Change (Prochaska & DiClemente, 1983, 1984, 1992) offers a promising systematic framework for this purpose. It provides a useful conceptual framework in understanding how people change behaviors. They go through a series of stages that include Precontemplation (not intending to change in the foreseeable future), Contemplation (considering changing in the foreseeable future), Preparation (intending to change in the near future with a specific plan or some steps towards action taken), Action (actively engaged in changing a behavior) and Maintenance (sustaining the change and preventing relapse) (Prochaska & DiClemente, 1992). These stages of change capture specific constellations of attitudes, intentions and behavior of individuals going through the process of change. Previous studies have found that stages of change, and other dimensions of the model which include decisional balance, and process of change were strong predictors of behavioral change. For example, stage differences were found to predict quit attempts in 1-month and 6-month follow-up with contemplation and preparation individuals more likely to made a quit attempt at both times (DiClemente, Prochaska, Fairhurst, Velicer, Velasquez, & Rossi, 1991). Among individuals who enrolled in behavioral weight control programs, individuals' stages and use of processes of change at admission as well as during treatment were among the strongest predictors of treatment outcome of weight loss (Prochaska, Norcross, Fowler, Follick & Abrams, 1992).

The purpose of the current study was to examine predictors of treatment outcome which

included individual characteristics at both pre-treatment (admission) as well as at discharge. Since there is no "gold standard" for treatment outcome, the most conservative measure -- status of total abstinence of drug use at 3-month follow-up -- was used as the measure for treatment outcome for the analyses. It has been evident that treatment is beneficial to drug addicts, yet the discrepant findings of a large body of literature on treatment retention and treatment outcome have presented doubts on the efficacy of treatment. In order to understand the elements that contribute to effective treatment, one question of interest is to identify which "changeable" or "dynamic" client characteristics can treatment have effects on so as to improve outcome. The goals of this study included the following: 1). examining the pretreatment predictors for treatment outcome, and 2). investigating potential useful discharge criteria for substance abuse treatment through assessing the predictive values of some 'dynamic' characteristics of treatment participants at discharge on treatment outcome.

Methodology

Participants

Participants were 385 clients (33% females) recruited for the study from a substance abuse residential facility. As participants admitted to the facility, they were randomly assigned to one of the 3-month and 6-month treatment. The treatment programs were based on a relapse prevention / health education model focusing on teaching coping skills for managing clients' addictive attitudes and behaviors in order to cope with high risk situations for relapse. Both "long" and "short" programs had essentially identical components except that the number of core group sessions of the 6-month program was twice as much as the 3-month program. The mean age of participants was 29.9 years (SD = 6.0). The ethnicity composition of the sample was 71.7% Caucasian, 20.0 African American, 7.39% Hispanic, and 1.0% other. The mean education level was 12th grade. About 34% of participants had a full time job at the time of

treatment and 45% were unemployed, while others worked part time, or had retired. Almost all (91%) of the subjects had previous admissions to drug abuse treatment programs prior to the study. Main drugs of choice were heroin only (19%), cocaine only(24%), alcohol and drugs (28%), and polydrug (26%), with 47% IV drug users.

Procedures

Participants were recruited during intake interviews at each facility that took place 14 days before or on the day of admission. Clients who were eligible to participate in the present study were all former drug abusers who completed detoxification or withdrawal and were admitted to the facility on a voluntary basis. Monetary incentives for participation were offered at $15 per interview at admission and discharge, and $25 for a follow-up interview. Admission interview took place in 2 to 3 sessions that occurred during the first 8 days after admission. Data at exit obtained from 7 days before anticipated day of discharge to 3 weeks after discharge, 77.7% (n=299)of the total subjects were interviewed within this window. Follow-up interviews took place with a 2- to 6-month window post discharge; 76.6% (n=295)were interviewed.

Measures

Addiction Severity Index (ASI)

The Addiction Severity Index (ASI) (McLellan, Luborsky, Woody, & O'Brien, 1980; McLellan, et al., 1985; McLellan et al., 1992) is a semistructured interview that collects data from substance abusers in seven problems areas: medical, employment, legal, alcohol, drug use, family-social functioning, and psychological status. The primary goal of developing the ASI was to provide an instrument to assess treatment outcomes over a broad range of potential areas which could be affected by substance abuse treatment and can be applied across different treatment settings (McLellan et al., 1992). The latest version, the fifth edition of the ASI, was used (McLellan et al., 1992), with the addition of questions on personal and family psychiatric

history. ASI covers general sociodemographics, as well as past and present information of each area. Composite scores can be computed from each area.

ASI is the most widely used clinical and research instrument in the area of substance abuse. The instrument has been validated across hundreds of studies during the past 14 years across different populations of substance abusers (e.g. Brown, Alterman, Rutherford, Cacciola & Zaballero, 1993; Hendriks, Kaplan, Limbeek, & Geerlings, 1989; Hodgins & Guebaly, 1992; McLellan et al., 1992). Studies in the area of substance abuse have frequently used ASI scale scores for evaluation treatment efficacy and to validate newly developed scales for this area (e.g., Darke, Ward, Zador, & Swift, 1991; Kang, Kleinman, Woody, & Millman, 1991; Kosten et al., 1987).

Change Assessment for Drug Use (CAD)

This 16-item questionnaire refined in Study 1 was used to assess subjects' readiness to change their problem behavior. Subjects were asked to respond on a 5-point Likert Scale ranging from 1= strongly disagree to 5=strongly agree. Four items comprised each of the four stages of change: Precontemplation (PC), Contemplation (C), Action (A) and Maintenance (M). This measure was administered at both admission and discharge interviews. The psychometric properties of the measure have been demonstrated in Study I with coefficient alphas ranging from .57 to .73 at baseline and .56 to .83 at exit. Stages of change at admission among participants were established in Study 2. Six clusters were found with three clusters (Uninvolved, Reluctant and Precontemplation) characterizing having no interest in quitting drug use, and three other clusters namely Contemplation, Preparation and Action. Stage membership at discharge was established in this study.

Decisional Balance Inventory

The 12-item scale modified from the Cocaine Decisional Balance Inventory (Rossi, Rosenbloom, et al. 1993) was used. With some wording changes replacing "cocaine use" with "drug use", this 12-item version has been shown to be a valid measure for the decisional balance construct in a sample of drug addicts in treatment (Tsoh, 1993). Subjects were asked to rate each item on a 5-point Likert scale ranging from 1= not important to 5= extremely important. The items represent PROS and CONS for drug use with 12 items on each dimension. The psychometric properties of this measure was further examined in the present study. Items of the measure are shown in Appendix C.

Self-efficacy to avoid drugs

This self-efficacy scale contains 5 items assessing subjects' confidence in their ability to avoid drug use in high risk situations during the next 3 months. Subjects were asked to respond on a four point Likert Scale: 1=extremely confident to 4=not at all confident. Total score is the sum of all 5 items reverse scored, with the higher total score indicating higher confidence. The scale was developed based on data collected in this study at admission through various versions of the instrument with an item pool of 11 or 24 items. The factor structure was refined using the shorter version (n=370) and was confirmed using the long version (n=217). The internal consistency as indicated by Cronbach's alpha, was .82 (Rubin, 1993). Items are shown in Appendix D.

Rosenberg Self-Esteem Scale

It contains 10 items assessing individuals' sense of self-worth, satisfaction with self, and belief in their own capabilities. Each item is scored on a four-point scale with 1=strongly agree and 4=strongly disagree. Test-retest reliability and validity in use with adolescent and young

adult populations has been adequate (Rosenberg, 1965). Improved in self-esteem is a favorable outcome particularly for those in therapeutic communities.

Beck Depression Inventory

It is a 21-item self-administered questionnaire developed by Aaron Beck (1967). The number and severity of current depressive symptoms are assessed. Adequate reliability has been established in studies of psychotherapy.

Shipley-Institute of Living Scale

It is a self-administered test of cognitive functioning (Shipley, 1939). It contains a verbal and an abstract section. Scores are age-corrected and can be converted to an estimated WAIS-R IQ score with mean=100, SD=15. The estimated WAIS-R IQ score was used in the current study. Administration of the instrument was timed and subjects were allowed 15 minutes to complete each section.

Diagnostic Interview Schedule, Third Edition Revision (DIS-III-R)

An abbreviated version of the DIS-III-R which incorporates items for the DSM-III-R diagnostic criteria (American Psychiatric Association, 1987) was used. Only questions needed to ascertain some pre-selected DSM-III-R diagnoses were asked. Those diagnoses include panic disorder, social phobia, major depressive disorder, dysthymia, alcohol abuse and alcohol dependence, antisocial personality disorder, and pathological gambling. The decision to focus on these diagnoses was based on considerations of prevalence of these disorders among drug abusers in treatment and evidence that particular disorders may be associated with treatment outcomes.

Social Desirability Scale

Jackson's Social Desirability Scale (Jackson, 1967) was used to assess response bias due to social desirability. This instrument consists of 20 items that are presented in a true-false

format. It has been found to be a valid and reliable measure to determine if a response set tends toward the direction of social desirability.

Biological assay of drug use

Hair analysis of drug use was used to validate against self-reported drug use at follow-up. Hair specimens of approximately 60 strands of hair were cut from the posterior vertex of the head as close to the scalp as possible. Radioimmunoassay (RIA) was used for hair analyses. It is believed to be the most widely used and the most sensitive chromatographic technique for this purpose (Strang, Black, Marsh & Smith, 1993). Hair, particularly that at the posterior vertex region, grows at a fairly constant rate of 1 to 1.5cm/month regardless of sex and age (see Hindin, McCusker, Vickers-Lahti, Bigelow, Garfield, & Lewis, 1994; Strang et al., 1993). The technique has been developed for cocaine, opiates, morphine, methadone, amphetamines, phencyclidine and other illicit substances and is the most developed for detecting cocaine and heroin use (Hindin et al., 1994). The amount of drugs detected through RIA is positively associated with the amount of drugs used during the relevant time interval (Baumgartner, Black, Jones, & Blahd, 1989, Hindin et al., 1994). Drugs ingested appear to remain for the lifetime of the hair, thus drug usage across time intervals can be revealed by segments of hair. Other biomarkers such as blood and urine can only show drug use over 2 to several days. Therefore there is no other measure that can document drug use over any period of time that can be used to truly validate RIA. Confirmation rates of positive RIA (indicates drug use) on self-reported drug use have been high especially at admission across studies (Hindin et al., 1994). Hindin and colleagues (1994) has found confirmation rates of 89% for cocaine and 96% for heroin and a lower rate at follow-up, suggesting that under-reporting of drug use at follow-up may be more common as compared to entering treatment.

Other variables

Data on other variables that have been associated with outcomes or retention from previous studies were also collected. Those variables included HIV status, sources of referrals, length of stay in treatment,

Variables of interest

Definition of Outcome Successful outcome was defined as total abstinence from drug use since exit from treatment. Outcome data were based on both self-report and biological assay of drug use from hair analysis. Among 295 individuals whose data were collected within the 2- to 6-month post treatment period, hair analysis was available for only 54.6% (n=161) of the individuals. Although findings on relationships between self-report and hair analyses were encouraging, a significant difference in total abstinence rates across sources of data (self-report alone vs. biological assay measure and self-report) was noted. Abstinence rate was 32.9% among individuals who had data on hair analysis as compared to 64.2% among those who did not provide hair to validate their self-report on drug use, $\chi^2=28.68$, $p<.001$. The significant higher abstinence rate obtained from the self-report-alone condition implied a high tendency for under-reporting of drug use post treatment. Owing to the apparent validity problem from self-report on the outcome measure (drug use post treatment), a more conservative approach was taken and only subjects who had data on hair analysis were included in the prediction analysis. Based on the combination of hair analysis together with self-report, abstinence rates were very similar between 3-month (33.3%) vs. 6-month (32.5%) programs. In order to maximize the number of subjects in the analyses, all subjects from both programs were used and enrollment in either the 3- or 6-month program was included as a variable in the analyses. Participant characteristics (n=165) included in the prediction analyses are presented in Table 4-1.

Predictor Variables.

Baseline Predictors. Predictors considered in the analyses of this study were collected during admission, which included all participant characteristics as listed in Table 4-1. Other variables include psychiatric diagnoses, depression level (Beck Depression Inventory), self-esteem (Rosenberg Self-Esteem scale), cognitive functioning (estimated WAIS-R IQ scores converted from Shipley), ASI composite scores of each area (medical, employment, legal, alcohol, drug use, family-social functioning, and psychological status), subjective rating from the ASI measure which include perceived severity of and perceived importance of treatment for each problem areas. The Transtheoretical Model relevant variables included in the analyses were pros and cons, self efficacy to avoid drugs, and stages of change. To maximize sample size, the Uninvolved, Reluctant and Precontemplation clusters were grouped as a combined Precontemplation cluster and was compared to other clusters, Contemplation, Preparation, and Action.

Discharge Predictors. Variables included length of stay in treatment, and other measures obtained at discharge: stages of change, pros and cons for drug use, self-efficacy to avoid drugs, self-esteem (Rosenberg self-esteem scale), and depression level (measured by the Beck Depression Inventory).

Analyses

Establishing Stages of Change at Discharge. To maximize sample size, all subjects that had discharge data from the facility were included regardless of their follow-up status. Before establishing stages of change membership at discharge, characteristics of subjects who had discharge data vs. those who did not have the data were compared through MANOVA, follow-up ANOVA and chi-square tests. Cluster analysis was used to assess homogenous subtypes of individuals based on the profile of the subscales of Change Assessment Drug Use (CAD) at exit.

This stage allocation method was found to be a better and more valid method for assessing stages of change in a substance abuse treatment client population (see Study 2). It involves grouping individuals according to their profiles based on these four scales: Precontemplation, Contemplation, Action, and Maintenance. Individuals were classified into subgroups based on the similarities they shared on their responses to the scales. Scale scores were converted into standardized T-scores with a mean of 50 and a standard deviation of 10. Ward's minimum variance method (Ward, 1963) was used as it has been demonstrated to be the most desirable method among other cluster analytic procedures (Milligan, 1980; Milligan & Cooper, 1987). Using Ward's procedure, each subject is treated as an individual cluster and then the clusters are merged into subgroups. The Euclidean distance measure of similarity was calculated for merging clusters with the smallest distance. Finally, the number of clusters was determined by the following guidelines: interpretability of distinct clusters, visual inspection of the cluster dendrogram (Aldenderfer & Blashfield, 1984), as well as the Cubic Clustering Criteria (Sarle, 1983; Milligan & Cooper, 1985).

To establish the internal validity of resulting cluster profiles, the following procedures were performed. The sample was first randomly split into an exploratory sample and a "hold-out" or calibration sample. After establishing cluster membership in the exploratory sample, cluster analysis was then conducted on the whole sample together with the calibration/"hold-out" sample. The stability of the cluster profiles established in the first exploratory analysis was then examined by comparing the resulting cluster profiles from the analysis with the additional subjects of the calibration sample.

The external validity of the clusters was assessed by examining the relationship between stage clusters and Decisional Balance Inventory, and Self-Efficacy to Avoid Drugs. A classic "crossover" pattern of Pros and Cons across various stages of change as found in other problem

behaviors was expected to confirm validity. Individuals in more "advanced" stages of change (e.g., Action) were expected to have a higher self-efficacy than those in "earlier" stages of change.

Lastly, the relationship between stages of change at exit and other baseline and exit variables were examined.

Identifying Predictors of Treatment Outcome. Logistic regression (LR) was used to examine significant predictors of treatment outcome. Three separate logistic regression models for predicting treatment outcome were tested: 1) predictors at baseline/pretreatment, 2) predictors at discharge; and finally 3) an overall model with all significant predictors from baseline and exit. The first model aimed at examining and identifying significant predictors presented when clients entered treatment. The regression model identified significant discharge predictors for outcome targeted to denote potential meaningful discharge criteria which have a relatively strong association with outcome. Lastly, the overall model aimed at comparing the predicting power of baseline vs. discharge variables for treatment outcome. LR was used to examine predictors of outcome instead of discriminant function analyses (DFA) because LR has been demonstrated as a more powerful technique for binomial variables. In the current study, outcome was dichotomously defined (abstinent vs. relapse) (e.g., Hosmer & Lemeshow, 1989; Norusis, 1990). Owing to the large number of variables at baseline/admission, they were initially subjected to a series of bivariates analyses such as ANOVA or Chi-squares procedures. Only variables that differentiated between abstainers (no drug use since discharge) and non-abstainers at a p-value of .20 (Hosmer & Lemeshow, 1989; Lemeshow, 1993) were included in the logistic regression analysis followed. For the analyses for the predictors at discharge for treatment outcome, all six discharge variables were included. For the LR analyses for model 1 & 2, a stepwise procedure was used. In model 3, significant baseline and exit predictors were

examined using a standard LR. After the identification of significant predictors in each model, first order interactions terms were tested. For the purpose of this study, identification of significant predictors in each model and their odds ratios, denoting predicting relationship between each variable and outcome were the parameters of interests.

Results

Establishing Stages of Change at Exit

Comparison between subjects who had exit data vs. not

A series of MANOVA and follow-up ANOVA, as well as chi-square tests were conducted to compare subjects who had exit data and those who did not. These two groups were very similar statistically in most characteristics except for length of stay in treatment, age, education level, and cognitive functioning (IQ score). Subjects whose exit data were available tended to have stayed in treatment longer (91.9 vs. 65.4 days; $F(1,383)=17.74$, $p< .001$), be older (30.2 vs. 28.7 years of age; $F(1,382)=4.18$, $p< 0.04$), be slightly more educated (11.9 vs. 11.2 years; $F(1,377)=7.28$, $p< 0.01$), and have slightly higher level of cognitive functioning (IQ scores:105 vs. 100; $F(1,324)=8.49$, $p< 0.01$). As findings from the previous study (Study 3) on predictors of treatment dropout indicated an association between some of these variables with length of stay (particularly education level), a MANCOVA using length of stay as a covariate was conducted on age, education and IQ score comparing the two groups. Results indicated a non-significant group effect on these measures when length of stay in treatment was taken into account as a covariate. Therefore, it appeared that whether or not exit data were available seemed to associate primarily with the length of stay in treatment. Therefore, interpretation of the results with exit data should take this finding into consideration.

Cluster analysis

The four scales, PC, C, A & M of the CAD were used as clustering variables. Scale statistics of the whole sample (n=264) with complete data on all the four CAD scales were included in the analysis. Individuals were classified into cohesive subgroups based on the similarities they shared on their responses to the CAD scales. Participants were randomly split into two independent samples (Sample 1: n=138; Sample 2 -- calibration sample n=126) for internal validation of resulting cluster profiles. Sample characteristics comparisons indicated the two samples were very similar.

In Sample 1 (n=138), solutions of 3 to 10 clusters were considered. A 4-cluster solution was the most interpretable. The clusters were labeled: Immotive (n=11), Precontemplation (n=21), Preparation (n=82), and Action (n=24). When a cluster analysis was performed on the whole sample (n=264) with the calibration sample(Sample 2; n=126) added, a 4-cluster solution was found most interpretable from the range of 3 to 10-cluster solutions considered. The cluster profiles were very similar to those identified in Sample 1 with respect to level, scatter and shape. The distribution of each cluster for the whole sample was: Immotive (n=29), Precontemplation (n=55), Preparation (n=92), and Action (n=88). The means and standard deviations for the scale scores of each cluster for Samples 1 and the whole sample are shown in Table 4-2 and Table 4-3 respectively. Each cluster profile is described below.

Immotive Cluster: This subgroup consisted of 8.0% of Sample 1 and 11.0% of the whole sample. Both profiles were characterized by high scores on the PC scale and well below average score on the C, A and M scales (Figure 4-1). Individuals denied their drug use as a problem and refused to participate in changing or even consider quitting drugs.

Precontemplation Cluster: This subgroup consisted of 15.4% and 20.8% of Samples 1 and the whole sample respectively. These individuals featured an elevated score on PC and

below to about average on C, A & and M scales (Figure 4-2). Individuals in this cluster were not considering or actively engaging in quitting drugs. Instead they seemed to deny their drug use as a problem and maintained the status quo with respect to their drug use.

Preparation Cluster: There were 59.4% of Sample 1 and 34.8% of the whole sample classified into this cluster. The cluster profile was characterized by a below average endorsement on both PC and M scales, and above average on the Contemplation and Action scales (Figure 4-3). These subjects have made a decision to change their drug use behavior and have started actively participating in changing. However, they have not yet experienced or recognized the risks of relapse (low endorsement of M).

Action Cluster: The 17.4% and 33.3% of Sample 1 and the whole sample respectively were classified into this cluster. The profile was characterized by below average scores on PC, but well above average scores on C, A and M scales (Figure 4-4). These individuals reported high investment and involvement in changing their drug use behavior, and have started to maintain their behavior change and work toward preventing relapse.

Regarding change in cluster membership from Sample 1 to the whole sample, most subjects in the Immotive (100%) and PC clusters (90.5%) remained in the same cluster memberships. In the PR cluster of Sample 1, 56.1% remained in the same cluster, 41.5% were classified into Action and 2.4% into Precontemplation. In the A cluster of Sample 1, 79.2% remained in the same cluster, 4.2% in PR and 16.7% in Precontemplation in the whole sample. The converging results from the cluster analyses conducted indicated that the cluster profiles identified were stable and internal valid. Therefore, the external validation of clusters proceeded with cluster membership derived from whole sample.

External validation of clusters with decisional balance and self-efficacy measures at exit

A one-way MANOVA was conducted using the stage clusters as the independent variable on three variables including the Pros and Cons for drug use and self-efficacy to avoid drugs. The MANOVA yielded a significant main effect, Wilks' $\Lambda = .69$, $F(9, 628.05) = 11.51$, $p < .001$, which accounted for 31% of the variance. Follow-up ANOVAs were conducted for each of the three scales to determine group differences. Significant main effects were found on all measures. Summaries of the follow-up univariate tests and the Tukey post-hoc tests are presented in Table 4-4. Figure 4-5 and Figure 4-6 illustrate the mean values for the Pros and Cons scales of the Decisional Balance for Drug Use and Self-efficacy across clusters respectively.

A stepwise discriminant function analysis (DFA) was performed using the three measures, Pros, Cons and Self-efficacy as predictors for the cluster membership. One significant discriminant function was found. Con was the primary predictor for the discriminant function with Wilks' $\Lambda = .69$, $\chi^2 (9) = 96.34$, $p < .001$, Canonical correlation (R_c^2) = .54. The centroid (score based discriminant function) for the I, PC, PR and A clusters were -1.69, -.18, .27, .38. The jackknifed classification analysis showed that 40.9% (as compared to 25% by chance alone) of the 264 participants were correctly classified into one of the 4 clusters. The most accurate classification occurred in the I cluster, where 72.4% of the sample was correctly classified, while the most misclassification occurred in A cluster, in which 33.0% was correctly classified with most participants (35.2%) classified into PR.

Relationship between Stages of Change and other Variables

A series of MANOVA, follow-up ANOVA and chi-square tests were performed to examine the relationship between stages of change at exit and other variables. Table 4-5 presents the significant cluster differences across various variables including length of stay in

treatment, education level, cognitive functioning level, age, self-esteem at discharge and depression level at discharge. There were no cluster differences on other demographic, drug use variables, or any of the ASI measures obtained at baseline.

Identification of Significant Predictors of Treatment Outcome

Baseline predictors of treatment outcome

After a series of bivariate analyses of baseline variables, variables with p-value <.20 were subjected to logistic regression analysis. The list of baseline measures included in the logistic regression analysis followed are presented in Table 4-6. A total of 142 participants with complete data were included in the following analysis. Stepwise logistic regression model examined all potential baseline/pretreatment predictors for outcome found that stages of change was the only significant baseline predictor. More specifically, Preparation individuals at admission were 3-5 times more likely to remain abstinent at 3-month post treatment as compared to their peers in other clusters. Table 4-7 presents the Wald statistics and odds ratios for the final LR model of outcome based on baseline predictors.

Discharge predictors of treatment outcome

All discharge variables were included in a stepwise logistic regression analysis for treatment outcome (abstinence of drug use since exit). The list of discharge measures included in the logistic regression analysis are presented in Table 4-8. Stepwise logistic regression model examined all potential discharge predictors for outcome on 109 participants with complete data, found that only the length of stay in treatment and depression level (BDI scores) at exit were significant predictors with depression level entered at the first step of the analysis. No significant interaction between length of stay and depression level was found. Table 4-9 presents the Wald statistics and odds ratios for the final LR model of outcome based on baseline predictors.

For interpretation purposes, the magnitude of the association between the length of stay in treatment, depression level, and abstinence was further examined by categorization of each predictor. For length of stay in treatment, two ways of dichotomization were tested: 1) stayed less than 60 days vs. continuers; and 2) stayed less than 80 days vs. continuers. For depression, three levels were tested according to clinical use of the Beck Depression Inventory: low (scores < 11), mild (scores between 11 and 17), and high (scores > 17).

When depression level is controlled, using cut off of 60 days stayed in treatment, continuers were more likely to be abstinent at 3 months (OR=7.68; 95% CI=0.91-64.70). When using 80 days stayed in treatment as cut off, individuals who stayed beyond 80 days were more likely to remain abstinent at follow-up (OR=3.50; 95% CI= 1.18-10.37). With length of stay in treatment controlled, individuals with low level of depression (scores < 11) at discharge were more likely to remain abstinent at follow-up as compared to those who reported mild depression (OR=3.09; 95% CI=0.99-9.63) and those who had high level of depression (OR=13.96; 95% CI=1.74-85.45). No significant difference was found between mild and high levels of depression in terms of their association with treatment outcome.

Baseline and Discharge predictors of treatment outcome

Significant predictors at baseline and discharge were examined in a step-wise logistic regression analysis to compare the relative power of prediction of treatment outcome. As indicated earlier, only three significant predictors for treatment outcome were found: stages of change at baseline, depression level at discharge and length of stay in treatment. Results indicated that only the discharge variables were significant predictors for outcome (Table 4-10). In addition, interactions were tested between baseline stages of change and length of stay in treatment as well as depression at discharge, no significant effects were noted. Therefore, the

results indicated that variables at discharge were more powerful in predicting outcome then the best baseline predictor.

Discussion

Stages of Change at Discharge

Current findings demonstrated the usefulness of the Change Assessment for Drug Use scale (CAD) to assess stages of change among drug addicts at discharge of treatment. Four clusters, Immotive (I), Precontemplation (PC), Preparation (PR), and Action (A) were identified at discharge denoting four major typologies of readiness for change among clients at discharge from relapse-prevention oriented residential programs. The clusters were externally validated by pros and cons for drug use, as well as self-efficacy to avoid drugs. A classic "crossover" pattern of pros and cons were observed across the clusters, with the precontemplative clusters (I & PC) having pros of drug use outweighed the cons, and the PR and A clusters reporting higher cons than pros of drug use. Both the strong and weak principles of behavior change (Prochaska, 1994) were demonstrated. On the cons of drug use, an increase over 15 T-scores (> 1 SD) from I to A was observed, which demonstrated the strong principle of progress. On the pros of drug use, a smaller decrease within 5 T-scores (0.5 SD) was observed from PC to PR, which illustrated the weak principle of progress. In addition, a gradual increase of self-efficacy to avoid drug use was noted across the clusters from I to A with A individuals reporting a significantly higher level of self-efficacy than those in the I cluster.

The significant differences across stages of change at discharge and other variables also have important implications for better understanding of stages of change and its potential interactions with treatment. First, findings clearly indicated that individuals who left treatment in the precontemplative stage of change had significantly shorter lengths of stay. As consistent with previous findings on predictors of dropouts (Study 3), individuals who were not ready to

change tended to drop out from treatment early. Second, as opposed to previous findings that no relationship was found between demographic variables and stages of change at admission (Study 2), current results showed that there were three demographic variables that had a significant relationship with stages of change at discharge. More specifically, individuals in A and PR at discharge, tended to be more educated and have a higher cognitive functioning level. Since education was found to be a significant predictor of treatment retention (Study 3), it might be that more educated individuals tended to be able to receive more benefits from treatment through staying longer in treatment. Or in other words, the current type of residential treatment programs focusing on relapse prevention and health education might tend to serve clients with a higher education level better. It should be noted that there was no significant difference across stages at admission on education level, and therefore the current findings are likely to denote the impact of education level on receiving treatment benefits.

Interestingly, individuals in I (Immotive) at discharge were younger than all other clients. Given that there was no evidence as shown in Study 3 that age affected length of stay in treatment, and they did not seem to drop out from treatment earlier than others, one reason for these individuals seeking or staying in treatment might be due to coercion rather than intrinsic motivating factors. Therefore, these individuals might just "go along" with treatment. The current treatment failed to help them value the cons of drug use or the benefits of staying off drugs. In addition, this group of individuals (in Immotive cluster) also reported a significant higher level of depression than all their peers at discharge (not at admission). These findings together might imply that one of the reasons for these individuals to be more "resistant" to change by this type of treatment was that treatment did not address their needs regarding dealing with their depression and negative emotions. To these individuals (young and depressed),

particularly, drug use may be the only convenient option they have to cope with negative emotions.

Consistent with the previous finding on self-esteem and stages of change (Study 2), PR individuals at admission, and those at discharge reported a higher level of self-esteem. These findings indicated that having higher self-esteem might be the characteristic that distinguished PR individuals from others, especially those who were not ready to change. For those who have made a firm decision to quit drugs and have been committed to their decision by actively participating and making progress in treatment, it is likely that these individuals would feel better about themselves. However, to what extent that self-esteem affects readiness for change, treatment retention, and outcome is unclear. Current findings on treatment dropouts and outcome suggested little influence that self-esteem might have on treatment outcome or retention.

Predictors of Treatment Outcome

Current results showed that there were more than 60% of clients who dropped out from treatment within the first 3 months. Nevertheless, the findings on predictors of treatment outcome were encouraging. Results clearly showed that dynamic variables outperformed static/fixed variables in predicting short-term (3-month) treatment outcome. Dynamic variables are dimensions that treatment providers can intervene upon and therefore, regardless of the demographics of the clients who are seeking treatment, they have an equal chance to succeed, since the parameters that predict outcome more strongly are changeable. Therefore, it appears that the key to improving treatment is to identify the dynamic parameters that associated with outcome.

Stages of change at admission was the most and only significant outcome predictor as compared to all other dynamic and fixed variables at admission used in this study. Findings have

suggested that only certain types of treatment works for certain types of clients. Based on research and theories of the Transtheoretical Model, successful change is dependent upon the appropriate use of a certain set of strategies or skills at each stage of change. Different stages of change require different strategies to progress to the next stage. For example, experiential processes of change, such as consciousness raising, and self-evaluation were significant to move individuals from precontemplation to contemplation, and become ready for action (Prochaska & DiClemente, 1992).

For individuals who were not ready to change, such as those who were in the precontemplative clusters, they did not receive treatment benefits probably because they tended to drop out from treatment early. Furthermore, before these individuals could learn the skills to quit drugs, they have to have the desire to quit first through understanding and identifying the benefits of quitting as well as the cons of using drugs. For contemplators, however, their immediate needs for treatment were to become "ready" for action (or moving on to the preparation stage). This process of getting ready requires further consolidation of their reasons for quitting which involves decreasing pros and increasing cons for drug use. Furthermore, they needed to be informed fully and be prepared for what it would take to quit drugs. Again, current program targeting behavioral skills for quitting, clearly had not met the immediate needs for these individuals. Even though these individuals might learn to master some skills for quitting, since most had not yet worked through the reasons for quitting, or were prepared for what it might take to stay off drugs, relapse among these individuals might likely result.

Preparation individuals were in fact the only subtype of clients who were more likely to remain abstinent three months after treatment. The treatment program in this study was based on a relapse prevention/health education model with emphasis on teaching individuals to identify high-risk situations on relapse and behavioral skills training for coping. The techniques that the

programs taught were most essential to prepare individuals for taking "action". In order words, being able to understand well the risks of relapse and master the skills for coping would be essential prior to moving on to exercising these skills to avoid relapse in a free environment. Results of this study clearly suggested that PR was a subtype of individuals who were able to benefit most from this kind of treatment. In other words, a relapse prevention type of programs might be a better match for those who were in PR at admission but not for others.

Interestingly, current findings indicated that Action individuals, in fact, did not differ from those precontemplative individuals in terms of outcome, and instead these individuals were more likely to relapse than those in Preparation. It may seem surprising that an "action-oriented" program did not seem to benefit individuals in Action but rather those in Preparation were more able to benefit from it. To investigate this observation, one way was to compare the major differences in characteristics between these two groups. First, previous findings (Study 2) indicated that Action individuals reported a significantly higher level of pros of drug use. Even though their value of cons still outweighed the pros, the difference between pros and cons was small. Perhaps because of the high level of pros, these individuals were more aware of risks of relapse (high endorsement of M scale) as compared to those in Preparation. However, their awareness of relapse did not necessarily make current treatment a good match for them. In this case, treatment failed to help them decrease the perceived importance of using drugs and therefore they continued to be at a high risk for relapse. It appeared that the previous treatment that those individuals had did not prepare them well to take action. This finding indeed has provided some support for the assumption that relapse might occur when moving someone too fast across stages without preparing them well prior to take acting and letting them master the specific strategies for each stage.

Generally, findings have supported the hypothesis that individuals who were more ready to change tended to have better outcomes than those who were not as ready to change. More importantly, the findings underscored the importance of a stage-match intervention for successful outcome. Furthermore, findings also underscored the importance of assessing other stage dependent construct so as to assess thoroughly the current status and needs of the clients. These constructs included processes of change, decisional balance, and self-efficacy.

Among all discharge variables, depression level was the strongest predictor. Clients who have a low level (within normal limit) of depression at discharge were up to 3 to 12 times more likely to have successful short-term outcomes than those who have mild to higher levels of depression. Previous studies have found similar results where the presence of psychopathology such as depression predicted negative treatment outcome (e.g., Ravndal & Vaglum, 1994). The current findings however, indicated the importance of intervening upon patients' depression level as well as focusing on teaching them to cope with depression, so that they might be less likely to relapse due to depressive symptoms.

As consistent with previous research, length of stay in treatment was found predictive of treatment outcome in this study. Staying longer in treatment tended to produce better outcome. Individuals who dropped out within the first two months were 7 times more likely to relapse than those who stayed beyond 60 days. Those who dropped out within the first three months were 3.5 times more likely to relapse. Thus far, the relationship between treatment retention and outcome remains unclear. As suggested by researchers, a minimal exposure of treatment is necessary to produce positive treatment outcome, and beyond that, perhaps, other factors might become essential to predict outcome. However, as in the case of most treatment programs, the majority of clients dropped out before treatment could fully take effect. Based on the current data and the finding on predictors for dropouts (Study 3), only stages of change at admission was the common

predictor for dropout and outcome. Again, findings have consistently provided support for stage-match intervention strategies that might reduce dropouts and improve treatment success.

Regarding the goal for setting up potential meaningful discharge criteria associated with outcome, results have indicated that depression level might be one of them. More specifically, clients whose depression was mild to high might not be ready to be discharged. However, as pointed out earlier, because of the limitation of the current available data at discharge, this finding should be interpreted cautiously. Studies in the future should investigate the role of stages of change, decisional balance, self-efficacy and processes of change at discharge and outcome.

In summary, this study has identified several predictors for short-term treatment outcome, which included stages of change at baseline, depression level at discharge, and length of stay in treatment. The findings have provided support for the importance of assessing stages of change and potentially intervening upon this dynamic variable to help improve outcome. Stages of change have been found predictive of both dropouts and outcome. More importantly, results have suggested that successful outcome requires matching individual needs. Stages of change represents an appropriate framework for identifying individual needs for recovery. Lastly, current results also indicated that future research focusing on outcome should include a biological marker for substance use.

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Table 4-1. Characteristics of Participants with Hair Analysis Available at Follow-up

Demographic Information		
Treatment Setting	**N**	**%**
Residential (3-month)	81	50.3
Residential (6-month)	88	49.7
Total	161	
Referral		
Legal	14	8.7
Self	147	91.3
Gender		
Male	97	60.2
Female	64	39.8
Age		
under 21	7	4.3
21-25	34	25.5
26-30	38	23.6
31-35	45	28.0
36-40	24	14.9
41 or older	13	8.1
Race		
Caucasian	127	79.9
African American	15	9.4
Hispanic	14	8.8
Other	3	1.9
missing	2	
Marital Status		
Single	100	65.4
Married / Living together	15	9.8
Separated	8	5.2
Divorced	29	19.0
Widowed	1	0.7
Missing	8	
Education		
< 12	48	30.6
High school	70	44.6
Some College	28	17.8
College	7	4.5
Post graduate	4	2.5
missing	4	

Table 4-1. Characteristics (cont'd)

	n	%
Yearly Income		
under $5,000	63	40.6
$5,000 - 9,999	21	13.5
$10,000 - 19,999	24	15.5
$20,000 - 29,999	7	4.5
$30,000 - 39,999	16	10.3
$40,000 or over	24	15.5
missing	6	
Employment Status		
Unemployed	71	45.2
Part time	19	12.1
Full time / self employed	56	35.7
Student / Retired	5	3.0
missing	4	
Legal Status		
Waiting charges	43	27.6
Probation / Parole	30	19.2
not applicable	83	53.2
missing	5	
HIV positive		
Yes	6	4.1
No/.Not sure	140	95.9
missing	15	
Previous Drug Abuse Treatment		
0	14	9.1
1	18	11.6
2-4	58	37.4
5 or more	65	41.9
missing	6	
Drug of Choice		
Alcohol only	7	4.3
Alcohol and drug	57	35.4
Cocaine only	29	18.1
Heroin only	32	19.9
Polydrug	35	21.7
Other	1	0.6
IV Drug Users ***(used IV during 3 months prior to admission)***		
Yes	84	52.2
No	77	47.8

Table 4-1. Characteristics (cont'd)

Age First Used Drugs		
Under 13	72	44.7
13-17	69	42.9
18-20	10	6.2
21-30	10	6.2
missing	0	
Age First Used IV		
Under 13	4	3.6
13-17	39	35.5
18-20	17	15.5
21-30	50	44.4
Total	51	
Types of Living Situation before Admission		
Free-living	69	42.9
Drug Treatment Centers	88	54.7
Jail	3	1.9
Hospital	1	0.6

Table 4-2. Change Assessment Questionnaire for Drug Use (CAD) Scale Scores for Each Clusters: Sample 1 (n=138)

	Raw		Standardized	
Clusters / CAD Scales	**Mean**	**SD**	**Mean**	**SD**
I. Immotive				
PC	2.57	0.94	63.43	12.60
C	2.67	0.95	26.49	13.53
A	2.78	0.75	29.05	10.14
M	3.55	0.68	36.48	9.17
II. Precontemplation				
PC	2.61	0.66	63.96	8.88
C	3.99	0.42	45.32	6.01
A	3.65	0.59	40.83	7.93
M	3.79	0.40	53.34	5.42
III. Preparation				
PC	1.21	0.31	45.24	6.87
C	4.54	0.37	53.22	5.24
A	4.63	0.41	54.02	5.53
M	3.31	0.51	46.77	6.92
IV. Action				
PC	1.41	0.52	47.90	6.89
C	4.59	0.50	53.85	7.14
A	4.63	0.40	53.89	5.35
M	4.60	0.30	64.30	4.10

Note:
1. CAD scales: PC - Precontemplation, C - Contemplation, A - Action, M - Maintenance
2. Raw scores of scale means range from 1 to 5
3. Standardized scale scores have M=50, SD=10

Table 4-3. Change Assessment Questionnaire for Drug Use (CAD) Scale Scores for Each Clusters: Whole Sample (n=264)

	Raw		Standardized	
Clusters / CAD Scales	**Mean**	**SD**	**Mean**	**SD**
I. Immotive				
PC	2.67	0.85	63.33	11.01
C	2.76	0.89	29.89	12.12
A	2.65	0.68	29.79	8.60
M	2.52	0.79	37.42	10.38
II. Precontemplation				
PC	2.42	0.62	60.01	8.11
C	4.08	0.37	49.60	5.05
A	3.94	0.58	46.21	7.40
M	3.84	0.38	54.74	5.00
III. Preparation				
PC	1.27	0.36	45.14	4.63
C	4.38	0.46	52.02	6.25
A	4.52	0.47	53.49	5.96
M	2.96	0.38	43.13	4.96
IV. Action				
PC	1.22	0.35	44.44	4.60
C	4.66	0.34	55.82	4.70
A	4.67	0.35	55.38	4.48
M	4.12	0.47	58.36	6.23

Note:
1. CAD scales: PC - Precontemplation, C - Contemplation, A - Action, M - Maintenance
2. Raw scores of scale means range from 1 to 5
3. Standardized scale scores have M=50, SD=10

Table 4-4. Cluster Differences of the Decisional Balance Inventory and Self Efficacy to Avoid Drugs at Discharge: Whole Sample (N=264)

Scales / Clusters	Mean	SD	Follow-up Pattern (Tukey post-hoc comparison)	F (3, 260)	Effect Size η^2
I. Pros for Drug Use					
1. Immotive (I)	51.60	10.07	PC > PR	3.32*	.04
2. Precontemplation (PC)	52.44	10.29			
3. Preparation (PR)	47.56	8.96			
4. Action (A)	50.49	10.42			
II. Cons for Drug Use					
1. Immotive (I)	36.27	12.05	A, PR, PC > I	30.06**	.26
2. Precontemplation (PC)	48.86	7.69	A > PC		
3. Preparation (PR)	52.02	7.91			
4. Action (A)	53.12	8.69			
III. Self Efficacy to Avoid Drugs					
1. Immotive (I)	45.57	15.20	A > I	2.93*	.03
2. Precontemplation (PC)	49.26	10.88			
3. Preparation (PR)	50.67	8.45			
4. Action (A)	51.25	8.41			

Scale scores are standardized with M=50, SD=10
* $p < .05$; ** $p < .0001$

Table 4-5. Cluster Differences on Participants' Characteristics: Whole Sample (N=264)

Scales / Clusters	Mean	SD	Follow-up Pattern (Tukey post-hoc comparison)	F - value
I. Length of Stay in Treatment (days)				
1. Immotive (I)	83.90	50.63	A, PR > PC	4.22*
2. Precontemplation (PC)	82.00	47.82		
3. Preparation (PR)	104.24	51.72		
4. Action (A)	107.13	47.08		
II. Education (years)				
1. Immotive (I)	11.48	1.55	A, PR > PC	5.53*
2. Precontemplation (PC)	11.07	2.96		
3. Preparation (PR)	12.43	1.64		
4. Action (A)	12.31	2.32		
III. Age				
1. Immotive (I)	25.76	5.46	A, PR, PC > I	7.79**
2. Precontemplation (PC)	29.94	5.92		
3. Preparation (PR)	31.84	6.48		
4. Action (A)	30.26	5.46		
IV. Cognitive Functioning (WAIS - IQ score)				
1. Immotive (I)	98.8	15.65	A, PR > PC, I	8.74**
2. Precontemplation (PC)	99.76	13.95		
3. Preparation (PR)	108.59	9.29		
4. Action (A)	106.76	11.61		
V. Self-esteem at Discharge (Rosenberg Self-Esteem Scale)				
1. Immotive (I)	29.41	5.62	PR > PC, I	5.17*
2. Precontemplation (PC)	30.43	4.10		
3. Preparation (PR)	32.54	3.87		
4. Action (A)	31.78	4.54		
VI. Depression Level at Discharge (Beck Depression Inventory)				
1. Immotive (I)	19.08	13.53	I > PC, PR, A	13.85**
2. Precontemplation (PC)	9.02	7.43		
3. Preparation (PR)	7.66	6.47		
4. Action (A)	9.16	7.11		

*$p < .001$, **$p < .0001$

Table 4-6. Baseline Variables included in Logistic Regression Analysis for Treatment Outcome: Univariate Results Comparing Abstainers and Relapsers

Demographic /Background Variables	Abstainers	Relapsers (any drug use since discharge)	p-value
Education Mean (SD)	12.24 (2.16)	11.74 (2.46)	.20
Number of previous treatment	4.28 (3.62)	5.73 (5.73)	.15
Legally referred	3.8%	11.1%	.12
Full time employment	54.7%	42.6%	.14
ASI measures:			
Composite score - Employment	0.70 (0.25)	0.79 (0.26)	.03
Perceived importance of treatment for specific problem areas (0-4)			
Alcohol	1.64 (1.93)	1.22 (1.78)	.17
Drug use	3.70 (1.07)	3.33 (1.38)	.09
Family	1.75 (1.91)	1.34 (1.75)	.17
Social	1.64 (1.88)	1.19 (1.88)	.14
Psychiatric	1.75 (1.85)	2.21 (1.86)	.15
Perceived severity of social problems (0-4)	1.66 (1.80)	1.18 (1.63)	.09
Psychiatric Diagnosis/ Functioning			
Antisocial Personality disorder	50.9%	63.3%	.14
Pathological gambling	11.3%	19.4%	.20
Panic disorder	7.5%	15.3%	.17
Major Depression	15.1%	24.5%	.18
Stages of Change (Clusters)			.05
Precontemplation	37.7%	46.3%	
Contemplation	20.8%	26.9%	
Preparation	24.5%	8.3%	
Action	17.0%	18.5%	

Table 4-7 Significant Baseline Predictor of Abstinence: Wald Statistics, Odds ratios (OR) and 95% Confidence Intervals

Predictor	Wald	p - value	OR	95% CI
Stages of Change (reference group = Preparation)	8.13	.043		
Precontemplation	5.07	.024	3.51	1.18 - 10.49
Contemplation	7.11	.007	5.04	1.53 - 16.53
Action	5.77	.016	4.73	1.31 - 16.84

Table 4-8. Discharge Variable Included in Logistic Regression Analysis for Treatment Outcome: Univariate Results Comparing Abstainers and Relapsers

Measures at Discharge	Abstainers (n=53)	Relapsers (n=108)	p-value
Length of stay in treatment (days)	115.79 (48.89)	84.36 (52.93)	.01
Stages of change at discharge			.47
Clusters % (n)			
Immotive	4.4% (2)	10.3% (7)	
Precontemplation	11.1% (5)	17.6% (12)	
Preparation	42.2% (19)	38.2% (26)	
Action	42.2% (19)	33.8% (23)	
Decisional Inventory			
(Scale mean ranged from 1-5)			
PROS	2.13 (0.89)	2.36 (1.01)	.21
CONS	4.39 (0.62)	4.17 (0.96)	.17
Self-efficacy	3.53 (0.32)	3.35 (0.41)	.01
(Scale mean ranged from 1-4)			
Self-esteem (Rosenberg)	32.40 (4.17)	31.03 (4.62)	.09
Depression level (BDI)	5.45 (4.50)	10.84 (8.9)	.01

Table 4-9 Significant Exit Predictors of Abstinence: Wald Statistics, Odds ratios (OR) and 95% Confidence Intervals

Predictors	Wald	p - value	OR	95% CI
Length of stay (months)	8.20	.004	.71	0.57-0.90
Depression (BDI score)	13.47	.001	1.14	1.06- 1.22

Table 4-10 Baseline and Exit Predictors of Abstinence: Wald Statistics , Odds ratios (OR) and 95% Confidence Intervals

Predictors	Wald	p - value	OR	95% CI
Stages of Change at Baseline	3.66	.30		
(Reference group: Preparation)				
Contemplation	2.99	.08	---	---
Preparation	2.95	.09	---	---
Action	1.08	.30	---	---
Length of stay (months)	8.20	.004	.71	0.57-0.90
Depression (BDI score)	13.47	.001	1.14	1.06- 1.22

Note: Odds ratios were presented for significant predictors only.

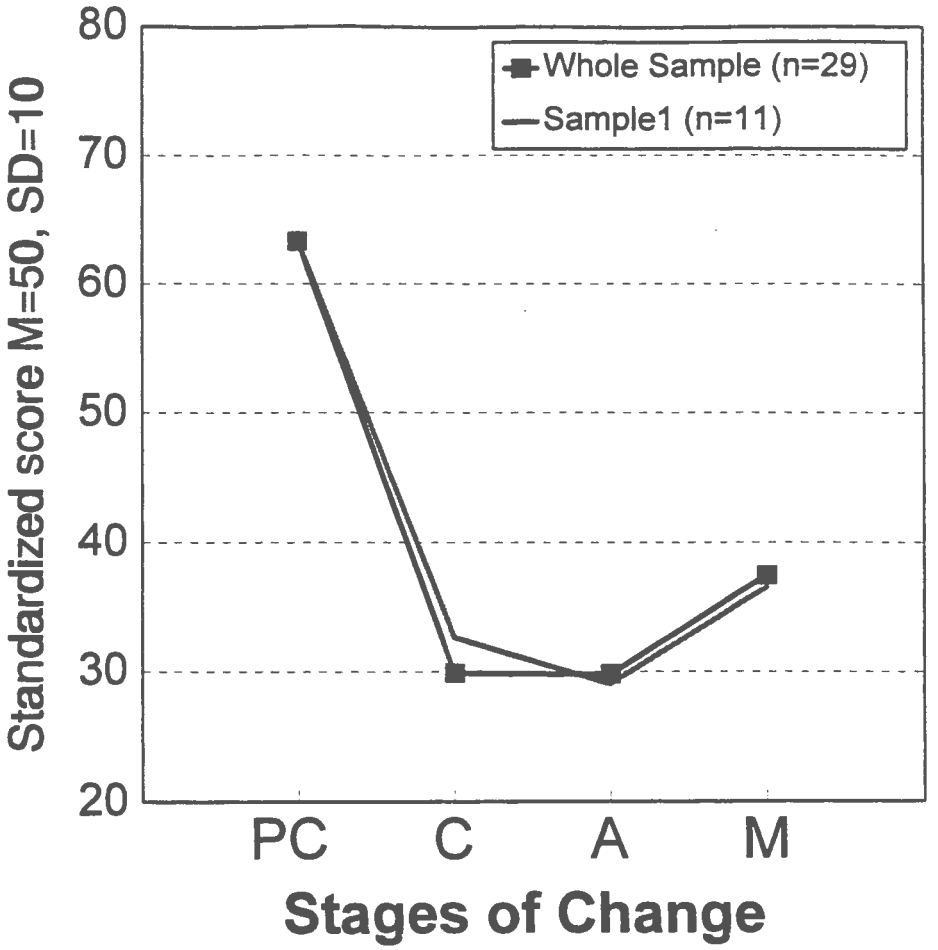

Figure 4-1. Immotive Cluster Profiles across Samples at Discharge

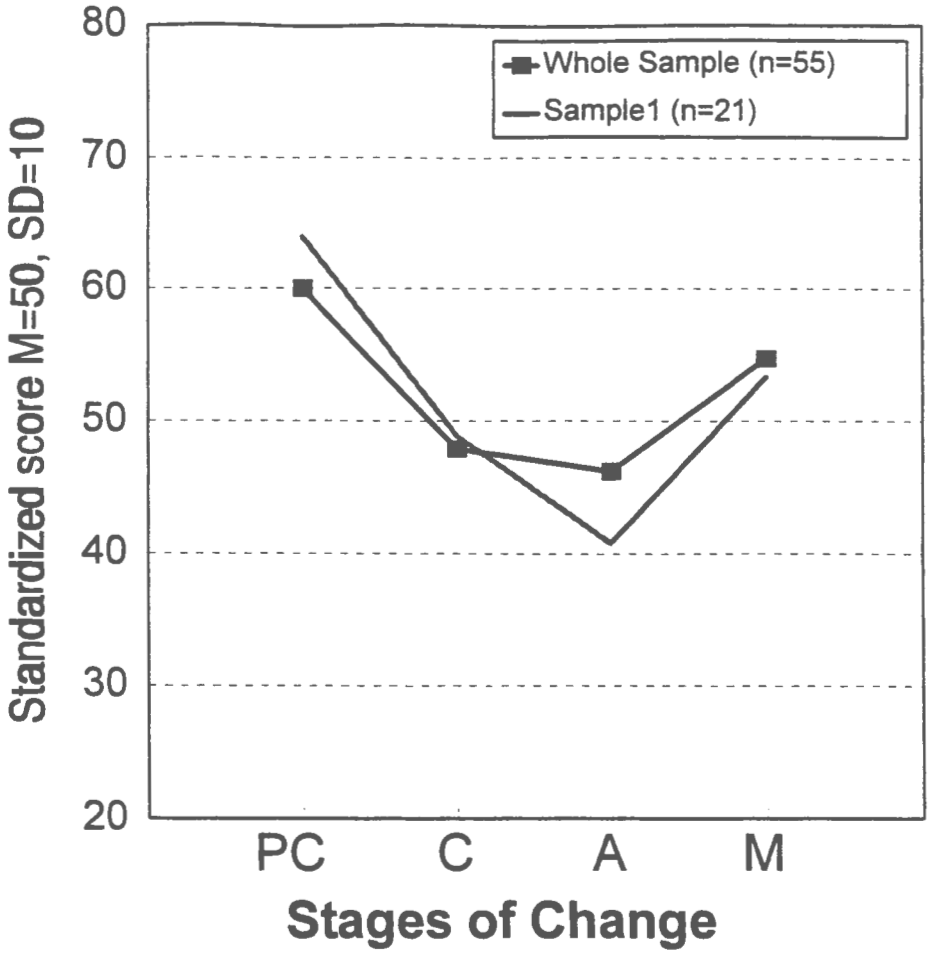

Figure 4-2. Precontemplation Cluster Profiles across Samples at Discharge

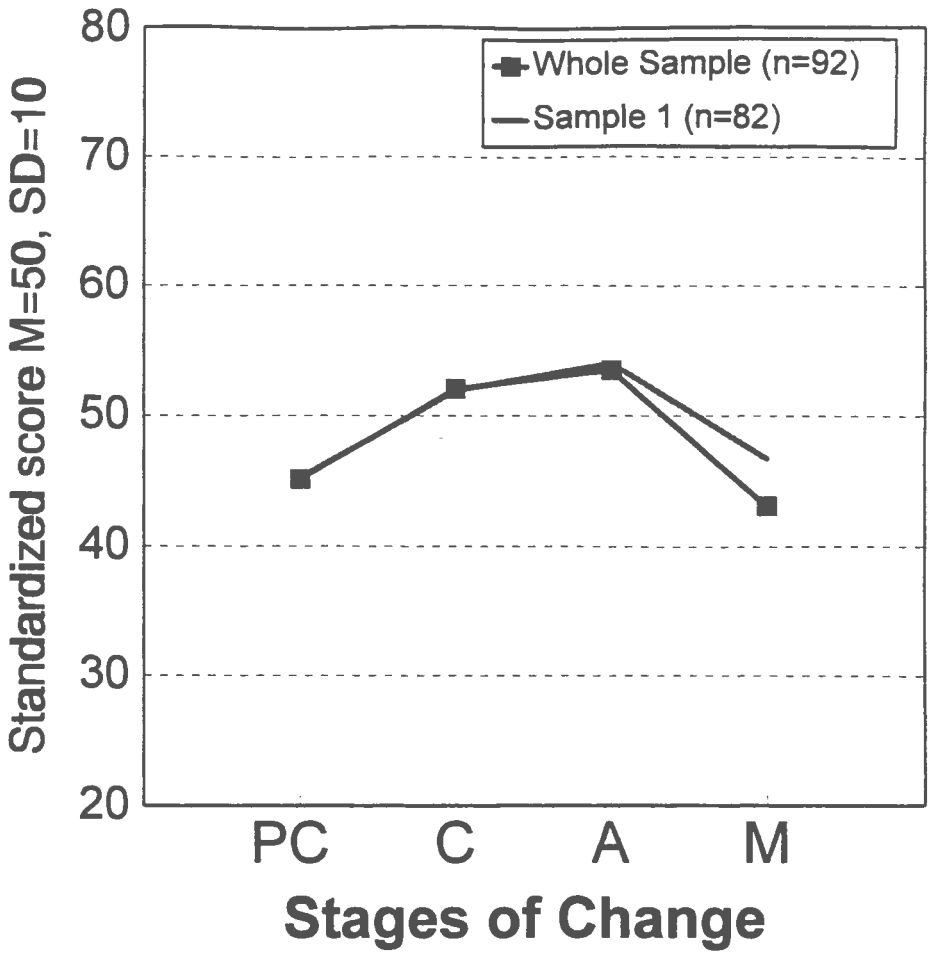

Figure 4-3. Preparation Cluster Profiles across Samples at Discharge

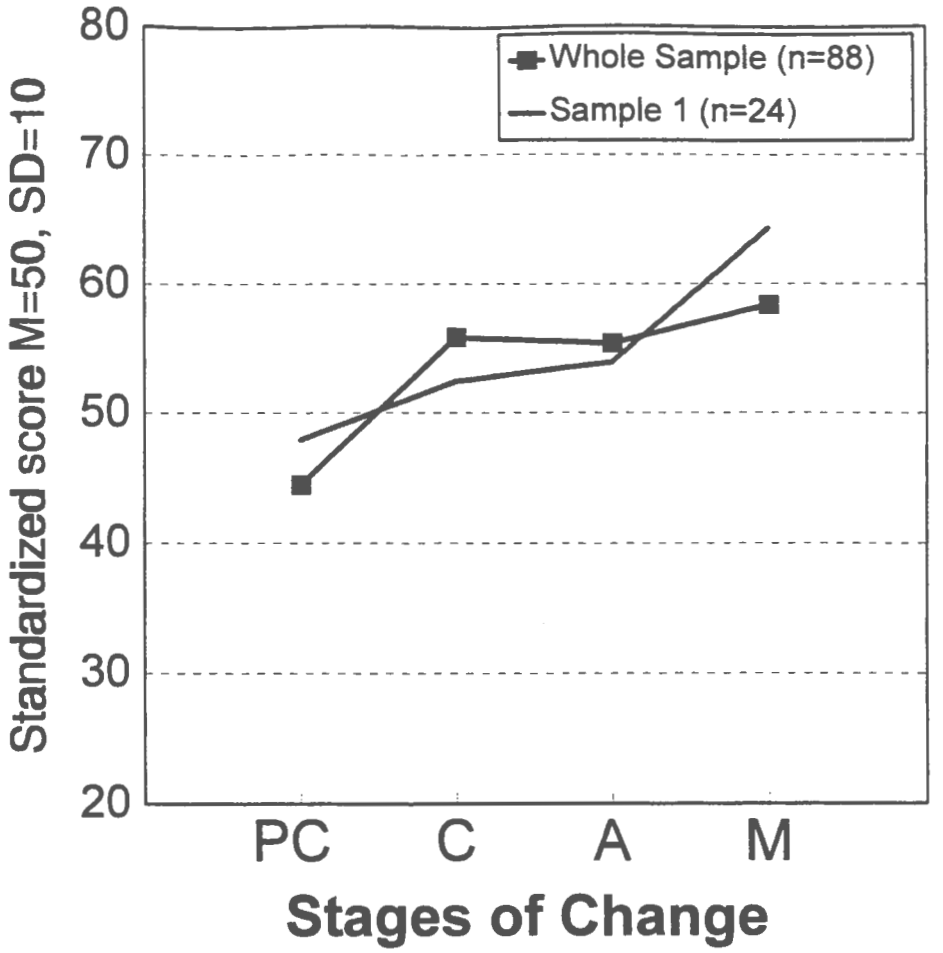

Figure 4-4. Action Cluster Profiles across Samples at Discharge

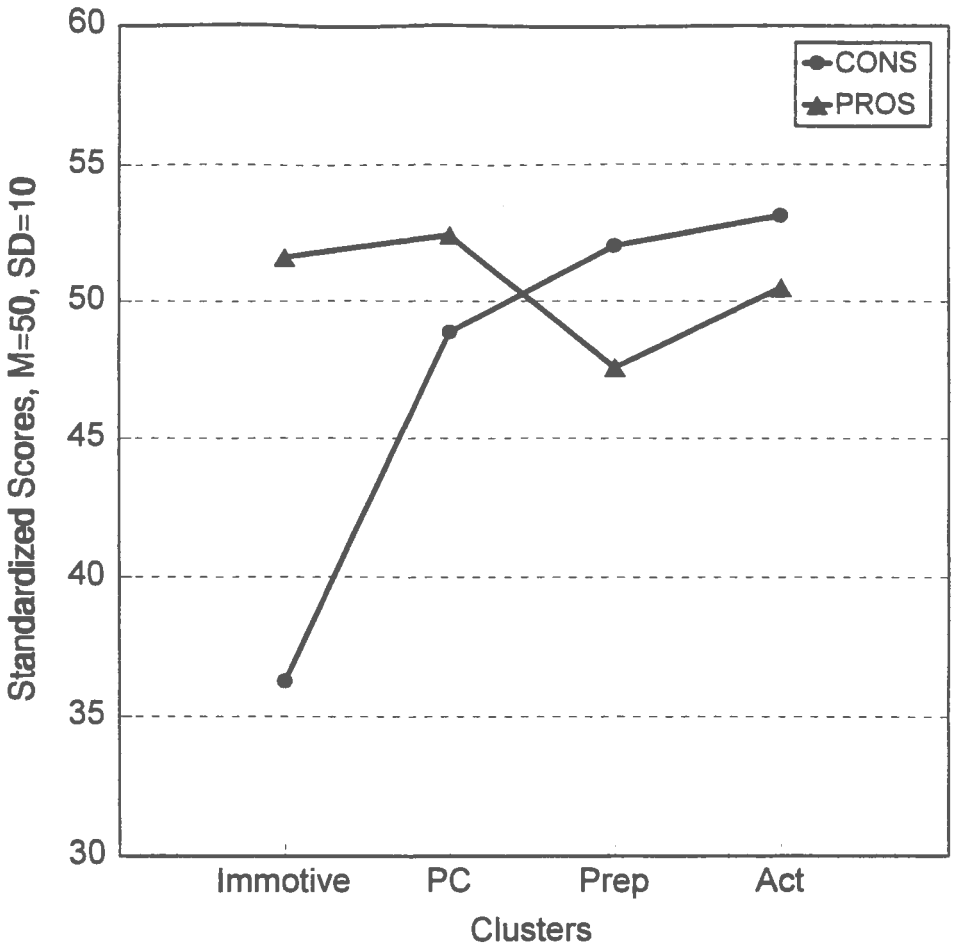

Figure 4-5. Decisional Balance for Drug Use across Clusters at Discharge

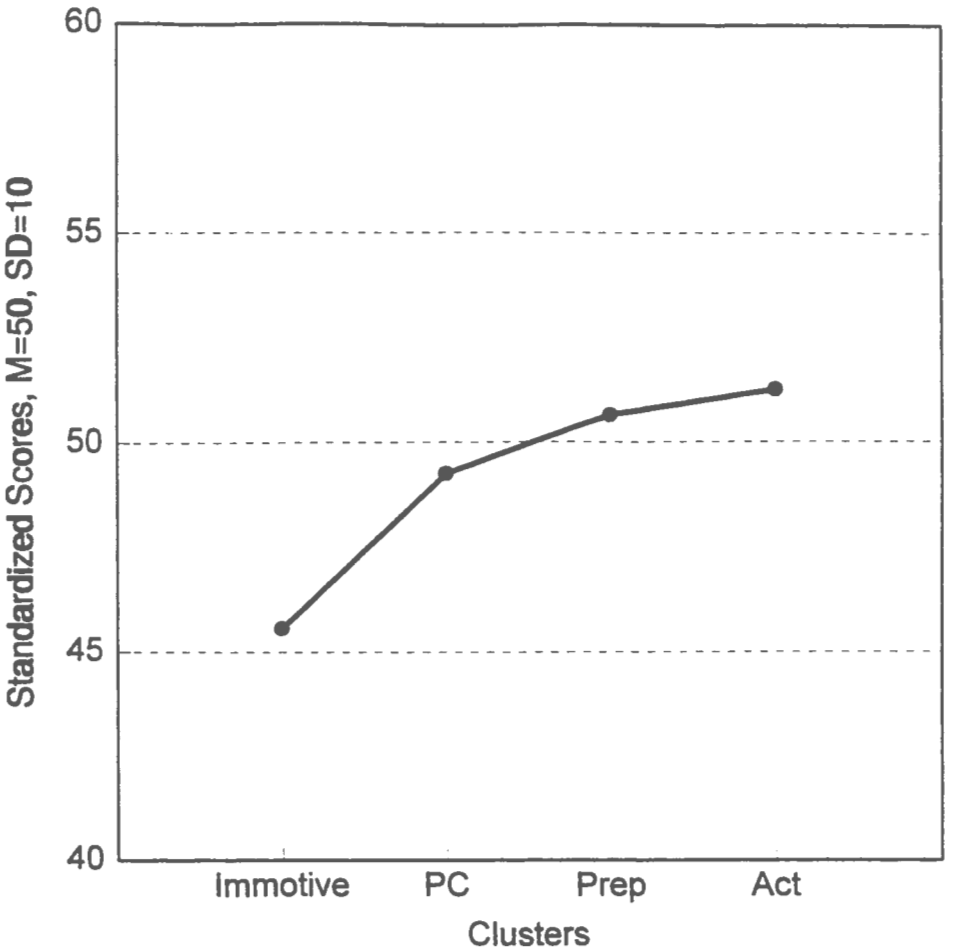

Figure 4-6. Self-Efficacy to Avoid Drug Use across Clusters at Discharge

GENERAL DISCUSSION

A 16-item Change Assessment Scale for Drug Use (CAD) was developed with reasonable psychometric properties. Findings demonstrated the validity of using the CAD at various time points: admission, discharge and follow-up, to assess stages of change. Cluster analysis based on standardized scores of the CAD was found to be the best method for identifying individuals into cohesive subgroups representing various typologies of readiness for change. Using CAD as a single continuous index for readiness for change also seemed promising. Based on the current sample of participants seeking treatment from two residential settings, relapse prevention/health education, and therapeutic community, six cluster profiles were identified. The profiles identified at admission included three precontemplative profiles(Uninvolved, Precontemplation, and Reluctant), contemplation, preparation, and action. Results clearly indicated over 45% of individuals presenting themselves to treatment were not ready to change. As demonstrated in a previous study (Tsoh, 1993), precontemplators in treatment reported significantly higher perceived coercion than those who were more ready to change. Current results showed that even though these precontemplative individuals sought treatment, they were 2 to 3 times more likely than others to drop out from treatment early. Therefore, although these individuals admitted themselves to treatment under some form of external pressure or coercion, once the pressure was ceased, they tended to drop out or have worse outcome even if they stayed in treatment longer. Consistently, stages of change at admission also predicted outcome. Indeed, it was the most significant predictor at baseline. Findings underscored the importance of matching clients' needs in promoting successful outcome. The results supported the theory on stages of change may be useful in identifying and understanding the needs of clients in substance abuse treatment for improving outcome. A "good match" of treatment for clients' needs could increase the odds for short-term treatment

success from 3 to 5 fold. The findings have suggested that a cognitive-behavioral relapse prevention focused program seem to benefit individuals in preparation the most.

Although current research showed validity and importance of stages of change among drug addicts, assessment of stages in this population could be a barrier for developing stage-match intervention for drug addiction treatment. While cluster analysis was shown to be an excellent research tool to explore cluster profiles of readiness for change, it requires a large number of subjects in order to obtain stable profiles. Therefore, cluster analysis can not be used to classify one or two individuals into subgroups based on their profiles. This has made assessing stages of change using CAD or URICA impractical in a clinical setting. Therefore, deriving a mechanism to empirically match individuals' profiles with previously identified typology profiles is necessary.

Some researchers have been aware of both benefits and barriers in using cluster analysis to develop typology profiles. Recently, discriminant function analysis (DFA) has been proposed as a promising approach to help solve the limitation of cluster analysis and to identify individuals into subgroups based on the clustering variables. Cherry (1993) first suggested the combination of cluster analysis and DFA to identify topology patterns of run-away-youth. DFA was conducted to derive discriminant functions based on a linear combination of clustering variables that maximized the differences among clusters. A 90% rate of correct classification based on the same sample was reported. Similarly, Carbonari and colleagues (1994) used the DFA approach to classify alcoholic participants into one of the five profiles that were identified using cluster analysis in another sample previously obtained (DiClemente & Hughes, 1990). Over 90% correct classification produced from DFA was reported within the same sample (DiClemente & Carbonari, personal communication, January 1995). Since no cluster analysis was performed among the participants recruited for Carbonari et al.'s study (1994), it was

unclear as to the accuracy of the classification as compared to cluster analysis. Although the preliminary results were encouraging, there has been no validation data available regarding the accuracy of using DFA approach using two independent samples for cross validation.

Based on the current data, the author attempted to investigate the use of DFA approach for classification as compared to cluster analyses. The two independent samples from Study 2 were used for cross validation. First, cluster membership of each individuals was established from previous cluster analysis performed separately on these two samples. The correct classification rates of DFA were 90.4% and 85.8% within the same sample, which were comparable to previous studies. Second, using the discriminant functions established from one sample reclassifying individuals from an independent sample into one of the clusters, the correct classification rates were 72% to 74% as compared to the actual cluster membership based on cluster analysis. Considering 16.7% by chance alone in predicting 6 clusters, the results obtained indicated that DFA could be used to generate a reasonably accurate classification rule. Since DFA is available in most statistical packages and does not have the limitation on sample size required for the analysis, once the typologies are developed, an individual's profile could be matched to existing profiles through discriminant functions developed previously. However, the most important issue then becomes the generalizability of the original typologies developed. One limitation of the current study is that the typologies developed were based on individuals who sought treatment in residential settings at admission, as well as at discharge. Further studies are necessary to further examine subtypes of readiness for change among drug addicts who seek treatment in other settings.

As consistent with previous findings, this study also found that length of stay in treatment was predictive of treatment success. However, little is known regarding the relationship between treatment retention and outcome. Stages of change at admission was found

to be the only common predictor for both dropouts and treatment outcome in this study. Further research will be necessary to examine the role of stages of change as a mediating variable between retention and outcome, or length of stay in treatment as a mediating variables between stages and outcome. Furthermore, changes in stages over time in treatment as well as changes in other dynamic measures such as decision balance, use of processes, and self-efficacy may add significantly to our understanding of treatment retention and outcome.

Lastly, this study only focused on short-term outcome. Therefore, findings could only be applicable for short-term outcome prediction. Long-term success or abstinence continues to be the ultimate goal for substance abuse treatment programs. From the experience of treating individuals with addictive problems, it is very common for addicts to succeed with at least several attempts or to recycle through the stages of change several times (e.g., Prochaska & DiClemente, 1992). Perhaps, as suggested by some researchers, in order to produce long-term success, individuals would need to effectively progress through each stage of change. The process of learning may require repetitive trials and through recycling the stages. Nonetheless, it is important to understand the process of recovery and what it takes to maintain long-term success. The current study, among many other studies, has provided support for the use of the Transtheoretical Model of Change as a promising framework to enhance our understanding of the treatment process that produces long-term success.

Appendix A Measurement Administration Schedule

Measures	Admission	Exit	Follow-up
Stages of Change Assessment	√	√	√
Decisional Balance of Drug Use	√	√	√
Self - Efficacy to Avoid Drugs	√	√	√
Rosenberg Self-Esteem Scale	√	√	√
Beck Depression Inventory	√	√	√
Addiction Severity Index	√		√
Sociodemographics	√		
Shipley Institute of Living Scale	√		
Drug treatment history	√		
Diagnostic Interview Survey	√		
Personality Diagnostic Questionnaire - Revised	√		

Appendix B Stages of Change Assessment Questionnaire

A. Each statement describes how a person might feel about his or her drug problem - apart from alcohol. Please indicate the extent to which you tend to agree or disagree with each statement. In each case, make your choice in terms of how you feel right now, not what you have felt in the past or would like to feel.

Administration: A cue card was presented to the subject when each item was read.

Cue Card:

There are FIVE possible responses to each of the items in the questionnaire:

1 = Strongly Disagree (SD)

2 = Disagree (D)

3 = Undecided (U)

4 = Agree (A)

5 = Strongly Agree (SA)

1. As far as I'm concerned, I don't have any problems that need changing.
2. I think I might be ready for some self-improvement.
3. I am doing something about the problems that had been bothering me.
4. It might be worthwhile to work on my problem.
5. I'm not the problem one. It doesn't make much sense for me to be here.
6. It worries me that I might slip back on a problem I have already changed, so I am ready to work on my problem.
7. I am finally doing some work on my problem.
8. I've been thinking that I might want to change something about myself.
9. I have been successful in working on my problem but I' not sure I can keep up the effort on my own.
10. At times my problem is difficult, but I'm working on it.
11. Working on problems is pretty much of a waste of time for me because the problem doesn't have to do with me.

Appendix B (cont'd.)

12. I'm working on my problem in order to better understand myself.

13. I guess I have faults, but there's nothing that I really need to change.

14. I am really working hard to change.

15. I have a problem and I really think I should work on it.

16. I'm not following through with what I had already changed as well as I had hoped, and I'm working to prevent a relapse of my problem.

17. Even though I'm not always successful in changing, I am at least working on my problem.

18. I thought once I had resolved the problem I would be free of it, but sometimes I still find myself struggling with it.

19. I wish I had moreideas on how to solve my problem.

20. I have started working on my problems but I would like help.

21. Maybe someone will be able to help me.

22. I may need some extra help right now to help me maintain the changes I've already made.

23. I may be part of the problem, but I don't really think I am.

24. I hope that someone will have some good advice for me.

25. Anyone can talk about changing; I'm actually doing something about it.

26. All this talk about psychology is boring. Why can't people just forget about their problems?

27. I'm working to prevent myself from having a relapse of my problem.

28. It is frustrating, but I feel I might be having a recurrence of a problem I thought I had resolved.

29. I have worries but so does the next guy. Why spend time thinking about them?

30. I am actively working on my problem.

31. I would rather cope with my faults than try to change them.

32. After all I had done to try and change my problem, every now and again it comes back to haunt me.

Appendix C Decisional Balance

Instructions (read by interviewers): The following statements represent different opinions about drug use. Again refers to drug s apart from alcohol. Please rate HOW MUCH each statement applies to you according to the following 5 point scale with 5= Very Strongly and 1 = Not at all.

Administration: A cue card was presented to the subject when each item was read.

Cue Card:

1 = Not at all
2 = A little
3 = Somewhat
4 = Strongly
5 = Very Strongly

1. I feel better about myself while using drugs.
2. Drugs make me feel more confident and sociable.
3. I am more fun to be with when I use drugs
4. My drug use has led me to act irresponsibly.
5. feel more confident when I use drugs.
6. When using drugs I fail to keep up with bills.
7. Drugs help me relieve tension.
8. As I became more involved with drugs, I pulled away from people I was once close to.
9. When using drugs, I borrow money which I fail to pay back.
10. Drugs give me that extra boost of energy.
11. Buying drugs has contributed to my experiencing some financial strain.
12. I experience sleep problems when I use drugs.

Appendix D Self Efficacy to Avoid Drugs

Instructions: (read by interviewers to subjects): Sometimes we really want to do something. At times we are confident that we can do it; at other times not so confident. I am going to read you a list of actions. For each one, tell me how confident you are that you could act this way in the next three months. Whenever I refer to drugs please not that I mean drugs apart from alcohol. Would you be:

Administration: A cue card was presented to the subject when each item was read.

Cue Card:

1 Extremely confident

2 Somewhat confident

3 Not very confident

4 Not at all confident

Items (refined)

1. When you feel confident in yourself you could avoid using drugs.
2. When you feel relaxed you could avoid using drugs.
3. When you are very anxious and stressed you could avoid using drugs.
4. When you are feeling angry or frustrated you could stay off drugs.
5. You could avoid situations and people that remind you of drugs.

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